Research Article

Study of the effect of intrathecal dexmedetomidine as an adjuvant in spinal anesthesia for Gynecological Surgery

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Abstract

Background: A randomized controlled study was designed to investigate the effects of addition of dexmetomedine to hyperbaric bupivacaine 0.5% for spinal anaesthesia in patients undergoing gynaecological surgeries, in terms of vital parameters, onset and duration of sensory andmotor block, intra and post operative pain and adverse effects. **Methods:** Sixty adult ASA Grade I and II patients were randomly divided equally in to dexmetomedine and control group. Control group received intrathecal 3.0 ml of 0.5% hyperbaric bupivacaine with 0.5 ml of normal saline and dexmetomedine group received identical volume of intrathecal dexmetomedine 5 µg with hyperbaric bupivacaine. **Results:** Mean time for post operative analgesia was significantly longer in dexmetomedine group (9.6 hours) than in the control group (3.55 hours). (p-value<0.01). Heart rate and blood pressure compared at 30 minute and 45 minute intervalswere significantly less in dexmetomedine group. (p-value< 0.05). Bradycardia and hypotension did not require any therapeutic intervention. Dexmetomedine group patients were found to be more sedated than control group. **Conclusion:** Adding dexmetomedine 5 µg to intrathecal bupivacaine prolongs the duration of spinal anaesthesia and analgesia. It is safe and is likely to be as effective as higher doses of bupivacaine without severe adverse effects

Keywords: Dexmetomedine, Bupivacaine, Intrathecal

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Introduction

Neuraxial block was first introduced in clinical practice by August Bier in 1898 and ever since neuraxial block has been the mainstay of anaesthesia for Surgery of lower abdomen and lower limb [1]. Spinal anesthesia is a well known technique for gynecological procedure. It is easy to perform and provides fast onset and effective sensory and motor block. In recent time various drugs are being used via subarachnoid and epidural route to provide optimum condition for surgery and post operative pain relief. Central neuraxial opioids has been extensively used till date.

Intrathecal Dexmetomedine (Alpha2 adrenergic agonist)is being extensively evaluated as an alternative to neuraxial Opioids for control of pain and has proven to be a potent analgesicα_2-Agonists are assuming greater importance as anesthetic adjuvants and analgesics[2]. Their primary effect is sympatholytic. They reduce peripheral norepinephrine release by stimulation of prejunctional inhibitory α_2-adrenoreceptors.

They inhibit central neural transmission in the dorsal horn by presynaptic and postsynaptic mechanisms and also have direct sympatholytic effects on spinal preganglionic sympathetic neurons.

Traditionally, they have been used as antihypertensive drugs, but applications based on their sedative, anxiolytic, and analgesic properties are being developed.

Dexmedetomidine is a new α_2-Agonists which is 1600:1 more selective for α_2 activity compared to α_1 in

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comparison of dexmetomedine which has α_2 : α_1 activity of 200:1. [3]

Material and Method

The Study group includes ASA grade I and II Patients ofage group between 18-60 years, undergoing gynecological Surgery. After obtaining informed consent and institutional approval 60 patients will be Selected for this study. Vital parameters like Pulse Rate, Blood Pressure, Resp Rate, Saturation will be recorded 10 Min prior to procedure and before Spinal and every 5 Min thereafter for 30 Min, after that every 10min till the procedure is over. Lumber Puncture will be done bymidlineapproach with the aid of a 25 Gbeveled spinal needle.

Group B (n=30) received 0. 5% Bupivacaine heavy 15mg total volume 3 ml.

Group BD (n=30) received 0. 5% Bupivacaine heavy 15mg+ 5 µg Dexmedetomidine total volume 3 ml.

Onset & level of Sensory and Motor block, duration of analgesia, haemodynamic changes, and level of sedation will be observed and recorded.All patients will be observed in post anaesthesia care unit and time of first analgesic requirement (Inj diclofenacI/V) will be recorded.

Methods of data collection: Preanaesthetic checkup includes detailed personal, family and anaesthesia history, clinical examination (CVS,CNS,RS,PA) and routine clinical investigations

Assessment of various parameters during spinal anaesthesia

Numerical VAS (before and after analgesia) 0-10, 0=no pain 10=severe pain)[4]
Level of sensory block (by pin prick method)
Level of motor block (by Bromage scale -4 points) [5]
Complications (Bradycardia, Hypotension, Nausia, vomiting, Respiratory depression.)

Inclusion Criteria

1.ASA grade I and II patients.
2.Age group 18-60 years

Exclusion Criteria

1. Patient refusal or uncooperative patient
2. Bleeding disorder
3. Neurological deficit.
4. History of seizures
5. Pregnancy

Ethical Consideration: After well written and informed consent typed both in Hindi and English the procedure will be done. The patient will have the right to withdraw and refuse to participate in the study at any point.Confidentiality of the patient data would be ensured.

Results

Both groups were comparable regarding their demographic characteristics as shown in Table I. Table II compares the time for onset of sensory and motor blockade in both groups. Time required for onset of sensory and motor blockade was similar in both groups. Duration of motor block was significantly more in dexmetomedine group. (244 ± 32.55). The difference in the mean duration of motor blockade among both the groups was significant (P< 0.00l). Mean time for post-operative analgesia was significantly longer in dexmetomedine group than control group (9.6 hours and 3.55 hour respectively)(p-value < 0.01) Table III Compares hemodynamic parameters (heart rate and systolic blood pressure) in both groups at different time intervals. Pulse rate and blood pressure was higher in control group at all time intervals as compared to dexmetomedine group.

Heart rate progressively reduced from 82.53±7.8 at 5 minutes interval to 69.73±8.08 at 30 minutes interval in dexmetomedine group (p-value < 0.05**)**. Mean heart rate was significantly higher at all time intervals in control group than in dexmetomedine group **(**p-value< 0.01**).** In dexmetomedine group we observed sedation score 0 in 9 patients, sedation score 1 in 16 patients and sedation score 2 in 5 patients while all patients from control group showed sedation score 0. Though patients from dexmetomedine group were found to be more sedated, respiratory depression was not observed. Respiratory rate and oxygen saturation (SpO2) were similar in both groups.

Table IV compares complications in both groups. There was no significant difference between the groups (p-value > 0.05). Complications in both groups were not serious enough to warrant any intervention. There was no morbidity.

Table-I: Demographic characteristics.

Parameter	**Dexmetomedine group(n=30) Mean ± SD**	**Control group (n=30) Mean ± SD**
Age (yrs)	34.4±7.56	35.33 ±7.4*
Weight (kg)	53.5±8.91	55.3±7.41*

*** p-value> 0.05** p-value significant at 0.05*** p-value significant at 0.01**

Table- II: Analysis of Sensory, Motor blockade and Duration of analgesia.

Parameter	**Dexmetomedine group (n=30) Mean ± SD**	**Control group (n=30) Mean ± SD**
Time in seconds for onset of sensory blockade	172.33±37.17	181 ±37.35*
Time in seconds for onset of motor blockade	302±57.97	288.3±53.848*
Duration of motor blockade	244±32.55***	167.5±23.44
Time for first rescue analgesia in minutes	574±63.17 ***	219±38.4

***p-value>0.05 ** p-value significant at 0.05 *** p-value significant at 0.01**

Table- III: Analysis of heart rate, systolic& diastolic blood pressure.

Measured at different interval from start of intrathecal block		0 min Mean±S.D	5 min Mean±S.D	10 min Mean±S.D	15 min Mean±S.D	30 min Mean±S.D	45 min Mean±S.D	60 min Mean±S.D	120 min Mean±S.D
Heart rate/min	Dexmetomedine group	83.86 ±9.4*	82.53 ±7.8**	79.13 ± 6.8**	74.4 ± 6.46***	69.73 ± 8.08***	70.13 ± 7.2***	71.93 ± 7.5***	79.2 ± 8.82**
	Control group	82.33 ± 17.71	86.8 ± 8.3	90.9 ± 6.4	93.3 ±5.84	83.4 ±10.3	84.06 ±7.76	84.86 ±7.64	83.66 ±6.62
Systolic B.P mm Hg	Dexmetomedine group	125 ±12.52*	123.66 ±11.59*	119.33 ±10.1 **	112.66 ± 7.68*	107.4 ± 10.7**	107.66 ±9.85***	109.66 ± 10.21***	110.33 ± 9.44***
	Control group	126.66 ± 12.12	124.3 ± 9.98	113.66 ±8.07	110.8 ± 7.38	114.4 ±11.8	116 ±10.56	117.33 ± 11.42	120.33 ±9.99
Diastolic B.P mm Hg	Dexmetomedine group	83 ±12.52*	82.66 ±11.59*	82.33 ±10.1 **	81.66 ± 7.68*	80.4 ± 10.7**	80.36 ±9.85***	79.66 ± 10.21***	78.33 ± 9.44***
	Control group	81.66 ± 12.12	81.3 ± 9.98	80.1 ±8.07	78.8 ± 7.38	78.4 ±11.8	77.6 ±10.56	77.33 ± 11.42	76.33 ±9.99

*** p-value> 0.05** p-value significant at 0.05*** p-value significant at 0.01**

Table IV: Complications.

Complications	**Dexmetomedine Group (n = 30)**	**Control Group (n = 30)**
Bradycardia	3	2
Hypotension	3	2
Urinary Retention	0	0
Dryness of mouth	9	4
Respiratory depression	0	0
Shivering	2	2
Position-dependent Headache	0	0

There was no significant difference between the groups. (p-value> 0.05).

Discussion

After the advent of spinal anaesthesia there was constant research on various adjuvants which when added to bupivacaineintensify theblock &prolongthe duration, without causing any major side effects. Takano Et al studied the characterization of the pharmacology of intratheally administrated α2 agonist &antagonist in rats, they also studied kinetics & dynamics of medullar agents & spinal action of α 2 adrenergic agonist as analgesics [6,7].

Furushima, Mori et al studied the effect of epidurally administrated dexmetomidine on sympathetic activity &post operative pain [8]. In humans,the dose of epidural dexmedetomidine reported is in the range of 1.5-2µg/kg.Fukushima et al. administered 2µg/kg epidural dexmedetomidine for the post operative analgesia in humans without any reports of neurogical deficits, similar studies were done by Singh et al &Bajwa et al who studieddexmetomidine as an adjuvant in spinal anaesthesia. [9,10]. Robert et al studied dexmetomidineas an adjuvant analgesic for intractable cancer pain exploring its analgesic potential [11].

High doses ofdexmetomidine resulted in bradycardia hypotension & sedation, therefore Kim J E et al studied low dose ofdexmetomidine in elderly patients undergoingtrans urethral resection of prostrate (TURP)[12], similar studies were done by Seop Chan et al [13] and found out the advantage of using low dose bupivacaine with dexmetomidine. In our study also hypotension, bradycardia & sedation were seen but not serious enough to warrant with any intervention, there was no morbidity.

In our study, we also found the time taken for sensory & motor block did not change significantly, but the mean time for post operative analgesia was significantly longer in dexmetomidine group (9.6 hours) than in the control group (3.55 hours). Abdullah et al, Al Mustafa et al & Wu HH et al also found similar increase in the duration of block after adding dexmetomidine as a neuraxial adjuvant, facilitating better anaesthesia and analgesic [14,15,16]. Jung et al & Kanazi et alalso did their studies on dexmetomidine and found result similar to our studies [17, 18]. In 2006, G.E. Kanazi, M.T. Aoud, et al. studied effect of low dose dexmedetomidine or dexmetomedine on the characteristics of bupivacaine spinal block. They compared the onset and duration of sensory and motor block, as well as the hemodynamics changes and level of sedation, following intrathecal bupiacaine supplemented with either dexmedetomidine or dexmedetomedine.[19]

Various other researchers such Halder et al (studied different doses of dexmetomidine), Gupta et al,(who compared dexmetomidine & fentanyl) as adjustments to bupivacaine, Shani et al (who compared magnesium sulphate to dexmedetomidine also pointed out the importance of adding low dose dexmetomidine as adjuvant [19,20,21]. In 2011 Rajni Gupta et al. have done comparative study of intrathecal dexmedetomidne and fantanyl as adjvant to bupivacaine. 60 patients classified in ASA I and II scheduled for lower abdominal surgeries were studied. Patients randomly allocated to receive either 12.5 mg hyperbaric bupivacaine plus 5µg dexmedetomidine (grp D) or 12.5 mg hyperbaric bupivacaine plus 25µg fentanyl (grp F) intrathecal. They found that patients in group D had a significantly longer sensory and motor block time than patients in fentanyl group F. The mean time of sensory and motor regression is longer in dexmedetomidine than fantanyl [20]. Solanki et al & Reddy et al compared dexmetomidinewith clonidine & found out dexmetomidine to be a better adjuvant for subarachnoid block than clonidine [22,23]. Hanoura at al compared dexmetomidine with fentanyl in terms of intra operative condition & quality of post operative analgesia in caesarian sections and found results similar to our studies [24].

Conclusion

Therefore to conclude, adding dexmetomedine 5 µg to intrathecal bupivacaine prolongs the duration of spinal anaesthesia and analgesia. It is safe and is likely to be as effective as higher doses of bupivacaine without severe adverse effects. Dexmetomidine thus can be considered a drug with new avenues & could be considered a wonder drugin today's world of modern anaesthesia practice [25,26].

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