Evaluation Of Effect Of Dexmeditomidine As An Adjuvant To Bupivacaine In Supraclavicular Brachial Plexus Block

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Abstract : **Background: Background & objectives** :To study the effect of dexmeditomidine as an adjuvant to bupivacaine in brachial plexus block on onset and duration of sensory and motor block, duration of analgesia, level of sedation,perioperative hemodynamic parameters and complications. **Methods:** fourty patients of ASA I and ASA II scheduled for upper limb surgery were included in double blind randomised comparison of inj. Dexmeditomidine and inj. Normal saline. We divided patients in two groups. Group A patients were given inj dexmeditomidine 50 microgm (0.5ml) and group B patients were given inj normal saline in brachial plexus block. We recorded time of onset and duration of sensory and motor block, level of sedation, duration of analgesia, hemodynamic changes and side effects in both groups. **Results**: mean time to onset of sensory block was 7.42±1.39 min in group A and 8.24± 1.35 min and that of motor block was 15.1± 2.6min in group A and 17.0± 2.9min in group B.Total duration of sensory block was 722.15±78.27min in group A and 360.62±61.7min in group B and that of motor block was 600.6± 54.46min in group A and 300.4± 54.26min in group B. Duration of analgesia was 970.36 ± 80.7 min in group A and 480±40.31 min in group B. **Conclusion:** addition of 50 microgm of inj dexmeditomidine to bupivacaine in brachial plexus block shortens onset and prolongs duration of sensory and motor block, prolongs duration of analgesia and decreases intraoperative requirement of sedatives. [Khade A et al NJIRM 2013; 4(6) : 122-127]

Key Words: Dexmeditomidine,Supraclavicular brachial plexus block,Analgesia,Sedation

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Introduction: Supraclavicular route for brachial plexus block was first introduced by kullenkampff in 1911 which was later modified as Winnie block[1]. The brachial plexus are blocked at the level of distal trunk and proximal division where they are compact in structure so just 30ml volume of local anaesthetic solution is adequate in an adult person.It achieves ideal operating conditions for forearm surgeries[2].

Dexmeditomidine belongs to imidazole subclass of α2 agonists[2]. Drug which has α2:α1 selectivity of 1600:1 which is 8 times that of clonidine.It has central action of sedation,hypnosis and analgesia by acting on locus caeruleus of brain stem. Several hypothesized mechanisms of action have been suggested to explain the analgesic effect of α2-adrenoceptor agonists. Some of these include vasoconstriction around the injection site,direct suppression of impulse propagation through neurons as a result of a complex interaction with axonal ion channels or receptors,local release of enkephalin-like substances a decrease in localized inflammatory mediators and an increase in anti-inflammatory cytokines through an α2-adrenoceptor–mediated mechanism[3] .It also has supraspinal analgesic action via noradrenergic neurons by hyperpolarisation.It inhibits norepinephrine release in descending medullospinal tract.Study was undertaken to compare inj. Dexmeditomidine 50 microgm(0.5ml) and inj. normal saline 0.5ml along with 30ml local anaesthetic in supraclavicular brachial plexus block for elective forearm surgery.

Material and methods: After obtaining approval from the institutional ethics commity,40 patients of ASA I and ASA II scheduled for elective forearm surgery were included in double blind randomised comparison of inj Dexmeditomidine 50 microgm and inj normal saline 0.5 ml.

	INCLUSION CRITERIA		**EXCLUSION CRITERIA**
1	Age of patient-18-60 yrs	1	Consent not given
2	Weight of patient 50-60 kg	2	Allergy
3	Written and informed consent	3	Significant neurological disease in upper limb

4	ASA I or II	4	psychiatric history
		5	Pregnancy and lactation
		6	Patient on anticoagulants or bleeding disorder
		7	Underlying significant systemic disorder
		8	Incomplete block(GA was given)

The study was carried out in department of anaesthesia, B.J. Medical college, Ahmedabad during October 2012 to feb 2013.written and informed consent was taken after adequqte explanation of procedure and complications.

All patients were assessed preoperatively and investigated. We divided patients randomly in two groups. group A patients were given inj. Dexmeditomidine 50 microgm + inj. Bupivacaine 0.5% 20ml + inj. lignocaine 2% 10 ml in supraclavicular brachial plexus block and group B patients were given inj.normal saline 0.5 ml instead of inj. dexmeditomidine along with above 30 ml of local anaesthetic solution..All patients had fasted for minimum 6 hrs. Under all aseptic and antiseptic precautions, we gave supraclavicular brachial plexus block to the patient with peripheral nerve stimulator technique. Sensory block was assessed by atraumatic pin prick test. Motor block was assessed by using four point scale of 0 to 3. Analgesia was assessed by visual analogue scale scoring 1 to 10.We assessed various parameters at 5,10,15,20,25 and 30 min, and thereafter every 15 min for 2 hrs 30 min and then hourly till block effect has resolved. It includes sensory as well as motor block onset and duration along with duration of analgesia, level of sedation. Sedation score was assessed by modified Wilson sedation scale[4]. which has scoring from 1 to 4.

Score1 –fully awake and oriented and follows verbal command

Score2 – drowsy, eyes closed but arousable only to commands

Score3- eyes closed but arousable to mild physical stimulation(ear lobe tug)

Score 4- eyes closed and unarousable to mild physical stimulation

Average sedation score was found to be 2.6 in Group A (dexmeditomidine) where as there was no sedation in Group B (normal saline) group. So inj. Midazolam 1mg. iv was given in almost all patients in group B that is of normal saline group. There was not a single episode of respiratory depression in either groups.

All the patients were monitored for vital parameters, sensory and motor blockade, level of sedation and complications if any. Pulse rate, Blood pressure and SpO_2 were recorded regularly throughout the period of study and post operatively till 24 hours. In our study the cardiovascular changes, i.e. heart rate and blood pressure changes were variable between both the groups. Vital parameters were monitored using multipara monitor. Pulse Rate, Systolic Blood Pressure, Diastolic Blood Pressure, Oxygen saturation were recorded at 0, 5, 10, 15, 30 ,60 , 120, 150 min and there after till the end of the surgery and at 1 hr,4 hr,6 hr,12 hr and 18 hr.

After calculating MEAN and STANDARD DEVIATION of all parameters, patient's age and duration of surgery were analysed by student's unpaired't'-test. Sex distribution and ASA gradings were analysed by chi-square test. Time for onset of adequate sensory block, duration of sensory and motor block were analysed by student's unpaired 't'test.

Sedation score was assessed by MODIFIED WILSON SCORE.[10] Comparison of intraoperative complications like bradycardia and hypotension were analysed by Fisher exact test. The p-value was considered significant as shown below:

$p > 0.05$ not significant, $p < 0.05$ significant, $p < 0.001$ highly significant

Result: The incidence of hypotension and bradycardia was higher in group A as compared to group B but it was statistically insignificant ($p>0.05$).Incidence of sedation was there in group A in almost every patient as compared to group B and it was statistically significant. Incidence of respiratory depression was not present in any case of either group which was monitored by oxygen saturation (spo2).Hypotension was treated with adequate intravenous fluids and Inj.

Mephentermine 6-12 mg i.v. and bradycardia was treated with Inj. Atropine 0.02 mg/kg i.v.

Table 1: Comparison Of Time Of Onset Of Complete Sensory And Motor Block

	Group A (dexmed)	Group B (normal saline)	P VALUE
Onset time for sensory block (min)	7.42± 1.39	8.24± 1.35	< 0.05
Onset time for motor block (min)	15.1± 2.6	17.0 ±2.9	< 0.05

Table 2: Demography

Parameters		Group A	Group B	p-Value
Age (Yrs) (Mean ± SD)		37.13 ± 14.14	37.2 ± 12.89	>0.05
Sex	Male	12 (73.3 %)	13 (66.67%)	
	Female	08 (26.7%)	07 (33.34%	>0.05
ASA Grade	I	08 (60 %)	07 (56.67 %)	
	II	12 (40%)	13 (43.33%)	>0.05

3: Comparison Of Time Of Duration Of Block, Analgesia And Level Of Sedation

	GROUP A INJ.DEXMED	GROUP B Inj.N. saline	P value
SENSORY BLOCK(MIN)	722.15±78.27	360.62±61.7	<0.001
MOTOR BLOCK(MIN)	600.6±54.46	300.4±54.26 min	<0.001
ANALGESIA (MIN)	970.36±80.7 min	480±40.31 min	<0.001
SEDATION SCORE(1-4)	2.6	1	

Table 4: Comparison Of Mean Pulse Rate

TIME (MIN)	GROUP A INJ. DEXMED (BEATS/MIN)	GROUP B INJ. N. SALINE (BEATS/MIN)	P VALUE
BASELINE	95.2 ± 4.24	94.2 ± 3.53	>0.05
5 MIN	91.4 ± 7.07	91.3 ± 2.82	>0.05
10 MIN	82.7 ± 4.24	84.3 ± 2.12	>0.05
15 MIN	70.1 ± 4.24	79.53 ± 3.70	<0.05
20 MIN	69.87 ± 3.89	78.13 ± 3.12	<0.05
25 MIN	66.7 ± 5.92	74.26 ± 4.24	<0.05
30 MIN	66 ± 5.65	79.2±3.53	<0.05
45 MIN	64.7±2.82	85.16±6.36	<0.05
60 MIN	66.7 ± 7.92	79.53 ± 0.70	<0.05
90 MIN	66 ± 5.16	70.43 ± 2.12	<0.05
120 MIN	67.7±2.88	74.26 ± 4.24	<0.05
150 MIN	68 ± 3.66	79.2±3.53	<0.05

Table 5: Comparison Of Intraoperative Mean Oxygen Saturation (Spo_2) (%)

	Group A (DEXMED) (%)	Group B (normal saline) (%)	p value
BASAL	99 35±0.4	99.40±0.30	p> 0.05
5min	98.5±0.9	99.25±0.45	p> 0.05
10 mn	99.25±0.5	99.30±0.5	p> 0.05
15min	96.35±0.8	98 0±.25	p> 0.05
20min	96.4±0.6	98.35±0.5	p> 0.05
25min	96.4±0.7	97.75±0.5	p> 0.05
30min	96.7±0.5	97.5±0.4	p> 0.05
45min	98.35±0.4	98.35±0.5	p> 0.05
60min	98.75±0.8	98.40±0.25	p> 0.05
120min	98.35±0.5	99 0±0.4	p> 0.05
150min	99.25±0.5	99.30±0.5	p> 0.05

Table 6: Comparison Of Mean Systolic Bp

	GROUP A (mm Hg)	GROUP B (mm Hg)	p-VALUE
0 min	121±9.29	124.56 ± 1.41	>0.05
5 min	117±5.65	118.3±5.65	>0.05
10 min	111.23±3.53	121.2 ± 5.65	<0.05
15 min	103.46 ± 7.09	122.76 ± 8.48	<0.05
20 min	102.7 ± 5.7	110.4 ± 1.41	<0.05
25 min	106.9± 6.17	114.3 ± 6.36	<0.05
30 min	100.16 ±1.41	118.43 ± 5.65	<0.05
45 min	103.86 ±18.38	123.56 ± 12.02	<0.05
60 min	112.7 ± 7.7	120.4 ± 1.41	<0.05
90 min	110.9± 6.17	124.3 ± 6.36	<0.05
120 min	110.16 ±1.41	128.43 ± 5.65	<0.05
150 min	113.86 ±18.38	123.56 ± 12.02	<0.05

Table 7: Comparision Of Mean Diastolic Bp

	GROUP A (mm Hg)	GROUP B (mm Hg)	p VALUE
0 min	82.13±2.12	82.16±2.82	>0.05
5 min	77.66±4.24	80.03±1.41	>0.05
10 min	72.23±3.7	74.36±7.07	>0.05
15 min	69.33±4.84	79.53±0.70	<0.05
20 min	62.16±1.44	82.16±2.82	<0.05
25 min	65.83±9.10	80.03±1.41	<0.05
30 min	66.16±1.41	76.1±5.44	<0.05
45 min	64.23±6.10	78.83±2.70	<0.05
60 min	67.83±9.89	76.5±2.12	<0.05
120 min	71.3±12.72	78.63±9.19	<0.05
150 min	75.63±12.72	77.13±6.36	>0.05

Table 8: Postoperative Changes In Mean Systolic Bp

	GROUP A	GROUP B	
TIME	Systolic BP (mm Hg) (Mean±SD)	Systolic BP (mm Hg) (Mean±SD)	p value
IMMEDIATE POST-op	118.2±7.63	121.1±6.55	p>0.05
1 hr	118.9±6.14	121.5±6.04	p> 0.05
3 hr	120.2±5.59	121.3±5.99	p>0.05
6 hr	120.5±5.17	122±5.34	p>0.05
12 hr	120.4±5.42	121.3±5.39	p>0.05
15 hr	120.2±4.77	120±5.54	p>0.05
18 hr	120.8±3.42	122.3±3.39	p>0.05

Table 9 : Postoperative Changes In Mean Pulse Rate

	GROUP A (DEXMED)	GROUP B (N.SALINE)	
Time	Pulse rate (Mean±SD)	Pulse rate (Mean±SD)	p value
IMMEDIATE POST-OP	68.86±4.86	78.66±5.97	P<0.05
1 hr	70.33±4.1	74.8±4.8	p> 0.05
3 hr	72.47±3.86	72±5.04	p>0.05
6 hr	71.33±3.89	73.27±4.66	p>0.05
12 hr	76.53±3.95	75.13±5.53	p>0.05
15 hrs	74.33± 4.16	74.81± 3.89	p>0.05
18 hrs	78.27 ±3.45	77.45± 4.58	p>0.05

Table 10 : Postoperative Changes In Mean Pulse Rate

	GROUP A (DEXMED)	GROUP B (N.SALINE)	
Time	Pulse rate (Mean±SD)	Pulse rate (Mean±SD)	p value
IMMEDIATE POST-OP	68.86±4.86	78.66±5.97	P<0.05
1 hr	70.33±4.1	74.8±4.8	p> 0.05
3 hr	72.47±3.86	72±5.04	p>0.05
6 hr	71.33±3.89	73.27±4.66	p>0.05
12 hr	76.53±3.95	75.13±5.53	p>0.05
15 hrs	74.33± 4.16	74.81± 3.89	p>0.05
18 hrs	78.27 ±3.45	77.45± 4.58	p>0.05

Table 11: Intra And Postoperative Complications

	GROUP A	GROUP B
Hypotension	2(10%)	0
Bradycardia	1(5%)	0
Nausea and vomiting	0	0
Sedation	18(90%)	0
Respiratory depression	0	0

Discussion: Demographic Data: . The mean age of patients was 37.13 ± 14.14 years in Group A and 37.2 ± 12.89 years in Group B (p=NS). The ratio of Male to Female was 12:08 in Group A and 13:07 in Group B. The ASA I patients in group A were 08 and in group B were 07 while ASA II patients in group A were 12 and in group B were 13. It shows there is no statistical difference between two groups.

Blockade Characteristics : SENSORY BLOCK In our study time to initial onset of adequate level of sensory block was comparable in both groups. It was 7.42± 1.39 min in Group A and 8.24± 1.35min in Group B(p<0.05).Total duration of sensory block was 722.15± 78.27min in group A and 600.6 ±54.46 min in group B(p<0.001). It shows that inj. Dexmeditomidine had shorter onset of action and longer duration of sensory block than inj. Normal saline and it was statistically significant. Our study findings are comparable to previous studies conducted by A Esmaoglu et al in 2010[5]. And Rachna Gandhi et al[6]. observed that there was no difference in onset of block when compared between dexmeditomidine and normal saline but there was significant prolongation of sensory and motor blockade with dexmeditomidine as compared to normal saline.

Motor Blockade; In our study time to initial onset of motor block was 15.1± 2.6 min in group A and 17.0 ±2.9 min in group B(p<0.05). Our results are comparable with study conducted by A Esmaoglu et al in 2010[5]. It was comparable in both groups.

Total duration of motor block was 600.6±54.46 min inj dexmeditomidine group and 300.4±54.26 min in normal saline group ($p<0.001$) . It was comparable to previous studies done by A Esmaoglu et al in 2010[5]. and by rachna Gandhi et al in 2012[6]. our study results were also comparable to study done by sarita s. Swami et al[8]. who compared dexmeditomidine with clonidine and found dexmeditomidine has longer duration of motor blockade. Rachna Gandhi et al[6]. observed that there was no difference in onset of motor block when compared between dexmeditomidine and normal saline but there was significant prolongation of motor blockade with dexmeditomidine as compared to normal saline.

Analgesia: Rescue analgesic was given in the form of inj. Diclofinac 1-2 mg/kg slowly iv. When VAS score reached 4. Duration of analgesia was found to be 970.36±80.7 min in dexmeditomidine group and 480±40.31 min in normal saline group which was statistically significant. These results were comparable with previous studies done by A Esmaoglu et al[5]. in 2010 and sarita s. Swami et al[8].

All previous studies also show that cardiovascular changes were variable between both the groups. There was bradycardia in one patient and hypotension in two patients in dexmeditomidine group which was statistically not significant and managed by iv fluids and inj atropine 0.6 mg iv. Our results are in consonance with A Esmaoglu et al[5] in 2010. who observed variable cardiovascular changes between the two groups. Our results are also in consonance with Sarita s. Swami et al[8]. We observed that the cardiovascular changes, i.e. heart rate and blood pressure changes were variable between both the groups. Dexmedimidine group has better hemodynamic stability compared to normal saline group.

Intraoperative and post operative complications:- In our study, intraoperative complications were not statistically significant in both groups. Incidence of Bradycardia was 5% (1/20) and that of hypotension was 10% (2/20) in dexmeditomidine group which was statistically not significant. Incidence of sedation was 90% (18/20) in dexmeditomidine and there was no sedation in normal saline group and this was statistically significant.There was not a single episode of respiratory depression in both groups. None of the patients had other side effects.

Our study findings are comparable to previous studies done by A Esmaoglu et al[5]. and rachna Gandhi et al[6].

Conclusion : We concluded that by adding 50 microgm inj dexmeditomidine as an adjuvant in supraclavicular brachial plexus block along with inj bupivacaine 0.5% 20ml and inj lignocaine 2% 10 ml.

1) Shortens onset of sensory and motor block.

2) Improves the block quality by increasing sensory and motor block duration

3) Increases the interval to first analgesic use

4)Provides better hemodynamic stability5) Decreases the intraoperative requirement of sedative medications.

References:

1. Barash P.Clinical Anesthesia sixth edition.20
2. Miller R.miller's anesthesia seventh edition.voi 2/2538 and vol 1/751
3. Ammar AS, Mahmoud KM. Ultrasound-guided single injection infraclavicular brachial plexus block using bupivacaine alone or combined with dexmedetomidine for pain control in upper limb surgery: A prospective randomized controlled trial. Saudi J Anaesth 2012;6(2):109-14. doi: 10.4103/1658-354X.97021
4. Némethy M, Leonardo,Williams R. and Thomas J. J. Blanck,Assessing Sedation with Regional Anesthesia: Inter-Rater Agreement on a Modified Wilson Sedation Scale; Anesth Analg 2002;94:723–8
5. Esmaoglu A, Yegenoglu F. Dexmeditomidine added to levobupivaine prolongs axillary brachial plexus block. A & A December 2010; 111: 1548-1551
6. Gandhi R, Shah A, Patel I. Use Of dexmeditomidine along with bupivacaine for brachial plexus block. National J Med Res. (2012)
7. Chad M.,Mary A. Norat, B.S.,John M. Palmisano B.S.,and Lydic R.Perineural Administration of Dexmedetomidine in Combination with Bupivacaine Enhances Sensory and Motor Blockade in Sciatic Nerve Block without Inducing Neurotoxicity in the Rat. Anesthesiology. 2008 September; 109(3): 502–511.
8. Swami SS, Keniya VM, Ladi SD, Rao R ;Indian J Anaesth.;Comparison of dexmedetomidine and

clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study; 2012 May;56(3):243-9

9. Rutkowska K, Knapik P, Misiolek H . ; The effect of dexmedetomidine sedation on brachial plexus block in patients with end-stage renal disease. 2009 Oct;26(10):851-5.
10. Kaygusuz K, Kol I O , Duger C, Gursoy S, Ozturk H, Kayacan U, Aydin R,Mimaroglu R .Effects of Adding Dexmedetomidine to Levobupivacaine in Axillary Brachial Plexus Block; Current Therapeutic Research2012;73(3): 103-111
11. Rutkowska K.; Knapik, P.; Misiolek, H.; Kucia, H.; Druzba, K. The effect of intravenous dexmedetomidine on brachial plexus block in patients with end-stage renal failure: European Journal of Anaesthesiology:June 2006 - 23 : 124
12. Abdallah F.W. and Brull R. Facilitatory effects of perineural dexmedetomidine on neuraxial and peripheral nerve block: a systematic review and meta-analysis; Br. J. Anaesth. (2013)doi: 10.1093/bja/aet066

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