Research Article

Adrenaline versus Clonidine as Adjuvants for prolonging Analgesia in Brachial Plexus Block via Supraclavicular Approach: A Randomized Double Blind Study

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ABSTRACT

Sixty patients between age of 18-60 years of ASA- 1st & 2nd undergoing orthopedic surgery in brachial plexus block were studied to compare the effect of adjuncts like epinephrine or clonidine in combination of bupivacaine and lignocaine in the brachial plexus block to study the onset & duration of block. These patients were randomly divided into group A and group B to receive 10 ml of lignocaine 2% and 15 ml of bupivacaine 0.5% with epinephrine or clonidine as adjuvants respectively. Onset of sensory blockade was determined by pinprick method by a three point score and motor blockade by three point scale. Duration of postoperative analgesia and any adverse effects were observed. It was found that there was faster onset of sensory and motor blockade and the postoperative analgesia was prolonged in group B as compared to group A. All the above findings were statistically significant. The study concludes that clonidine is a better option as an additive than epinephrine for sensory and motor block with prolonged postoperative analgesia.

KEY WORDS: brachial plexus block, bupivacaine, clonidine

INTRODUCTION:

The brachial plexus block via supraclavicular approach provides complete and reliable anaesthesia for elbow, forearm and hand surgery. Various adjuvants had studied like clonidine, adrenaline, dexmetomidine, tramadol, midazolam, soda bicarb, fentanyl etc. Tramadol and fentanyl had been successfully used as adjuvants to local anesthetic in brachial plexus block[1,2]. The concurrent injection of two adrenergic agonist drugs has been suggested to improve the nerve block characteristic of local anesthetic solutions through either local vasoconstriction[3] and facilitation of C fiber blockade[4] or a spinal action caused by slow retrograde axonal transport or simple diffusion along the nerve[5].

Clonidine is a selective alpha-2 adrenergic agonist with some alpha 1 agonist property. In clinical studies, the addition of clonidine to local anesthetic solutions improved peripheral nerve blocks by reducing the onset time, improving the efficacy of the block during surgery and extending postoperative analgesia[6,7]. The effect of clonidine is dose related between 0.1 and 0.5 μg/kg[7]. Clonidine possibly enhances or amplifies the sodium channel blockade action of local anesthetics by opening up the potassium channels resulting in membrane hyperpolarization, a state in which the cell is unresponsive to excitatory input[8].

Certain theories have been postulated like clonidine may interfere vasoconstriction by reducing vascular resorption of local anaesthetics[10] or clonidine may have a direct action on neural tissues11, especially at spinal level or it may induce analgesia via a systemic mechanism after vascular resorption and secondary distribution to the brainstem[12]. There are evidences of direct action of clonidine on alpha 2 receptors in various studies[11-19].

Addition of epinephrine is widely used additive to local anaesthetic to prolong anaesthesia. Hence, the study was focused on an alpha-2 agonist like clonidine as an additive, comparing with epinephrine.

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The aim of this randomized double blind study was to compare additives like epinephrine or clonidine to local anaesthetics for onset of sensory and motor block, duration of analgesia, the hemodynamic changes, level of sedation and complications in brachial plexus block.

MATERIALS AND METHODS:

Sixty ASA physical status I and II, aged 18-65 years of either sex undergoing orthopaedic upper limb surgical procedure were included in this study. Patients with history of cardiac, respiratory, liver and renal problems, pregnant women, coagulative disorders, drug allergy or sensitivity to drugs, cutaneous infection at the site of injection site were excluded from the study.

After complete pre-anaesthetic check-up, all the patients were nil orally for 6 hours before surgery. On the day of surgery, 18 G intravenous cannula was inserted on non-surgical arm of the patient. Inj. Ondansetron along with Inj Ranitine was given to all the patient. The patients were randomly alloted to two groups (A & B) of 30 patients each.

As the patients are alloted in 2 groups, they were shifted to OT complex. All the monitors were attached to the patient along with the IV fluids. Supraclavicular brachial plexus block was then performed by the same experienced anaesthesiologist using classical approach with 10ml 2% lignocaine and 20ml 0.5% bupivacaine. Local anaesthetic was supplemented with 1ml of either 200µg of epinephrine (group A) or 90µg of clonidine (group B). Experienced anaesthesiologists were involved to perform a double blind study and prevent observer's bias. Preoperative antianxiety and sedative drugs were avoided to study the sedative effect of the additive drug.

Following criteria were assessed in the operating room
a) The time to onset of sensory blockade according to a three point score by pinprick method:
Grade-0: Anaesthesia- no sensation felt; Grade-1: Analgesia - dull sensation felt; Grade-2: Sharp pain felt.

Sensory score of 2 was taken as time to onset of sensory block.
b) The time to onset of motor blockade according to a three point scale:
Grade - 0: Complete paralysis; Grade - 1: Paresis; Grade - 2: Normal muscle force.

Motor score of 2 was taken as onset time of complete motor block.

Onset of block was monitored every one minute for 20 minutes. Heart rate, blood pressure, SpO2 were measured before anaesthesia(baseline), at premedication, in operation theatre T0, at 5 minutes interval i.e. T5, T10, T15, T20, T25, T30, T45, T60, T75, T90, T105, T120 and postoperatively at 15, 30, 45 and 60min, 2, 3, 5, 8, 12, 15 and 18 hours. The degree of analgesia was assessed during surgery and in the postoperative period according to a VAS score. VAS score of >5 was considered as end of analgesia. Hemodynamic changes, level of sedation, any other complications were noted. Recording of sedation score was started pre-operatively & continued intra-operatively at an interval of 15 minutes, & hourly post-operatively for 8 hours.
Sedation score is:
Grade 1 - awake and alert; Grade 2 - sedated, responding to verbal stimulus; Grade 3 - sedated, responding to mild physical stimulus; Grade 4 - sedated, responds to moderate or severe physical stimulus.

Observations were recorded & tabulated. All the values were expressed as mean ± standard

Table 1: Patients Characteristics and Duration of Operation.

	Group A	Group B	t -value	p-value
Age (years)				
Mean ± SD	35.54 ± 12.18	35.5 ± 15.45	0.018	0.08
Range	18-65	20-64		
Gender				
M	16	13		
F	14	17		
Height (cm)				
Mean ± SD	158.1 ± 4.14	156.2 ± 4.03	1.46	0.14
Range	150-166	148-167		
Weight (kg)				
Mean ± SD	61.47 ± 8.76	63.3 ± 6.68	1.37	0.17
Range	40-80	54-79		

Table 2: Onset of Sensory Block and Motor Block (Seconds).

	Group A	Group B	t-value	p -value
Sensory blockade				
Mean ± SD	196.37 ± 20.94	135.9 ± 15.66	12.3	<0.0001
Range	182-244	122-178		
Motor blockade				
Mean ± SD	312.38 ± 32.2	283.1 ± 32.56	11.98	<0.0001
Range	310-410	204-360		
p<0.0001, Significant				

Table 3: Duration of Analgesia (Minutes).

	Group A	Group B	t-value
Mean ± S.D.	710 ± 62	826.1 ± 92	3.18
Range	665-830	740-1230	
p<0.001, Significant			

Table 4: Systolic Blood Pressure Changes.

Time	Group A	Group B	t-value	p-value
Pre-op	122.45 ± 8.57	127.76 ± 8.36	0.74	0.5
Pre-med	128.12 ± 9.12	125.43 ± 9.11	0.45	0.85
0 min	126.51 ± 7.13	126.98 ± 7.29	0.31	0.91
15 min	120.38 ± 7.07	126.29 ± 9.34	0.82	0.18
30 min	129.93 ± 6.98	127.19 ± 7.99	1.53	0.53
45 min	125.04 ± 5.63	126.52 ± 9.63	0.82	0.19
60 min	125.29 ± 7.08	128.27 ± 8.92	1.29	0.12
75 min	124.53 ± 6.91	125.48 ± 9.37	1.7	0.47
90 min	122.90 ± 6.37	127.28 ± 7.35	0.9	0.39
120 min	123.47 ± 7.35	126.48 ± 9.43	0.97	0.24
Post-op	124.94 ± 6.99	125.73 ± 9.88	0.8	0.07

deviation. The student's 't' test by software version 11.1.1.0 was applied to compare the values for significance. The p value of <0.05 was taken as significant.

RESULTS:

The difference between the 2 groups in regard to age, gender, height, weight and duration of surgery were found to be insignificant (Table 1).

Onset of sensory and motor block were earlier in group B as compare to group A (Table 2).

Also the total duration of analgesia was longer in group B than in group A (710 ± 62 vs 826.1±92, p<0.01) Table 3).

No differences were noted in the hemodynamic parameters during surgery (Table 4,5,6).

However, the sedation score was significant (p<0.001) between two group after 30 min and remained so for 8 hours postoperatively (Table 7). No side effects were noted in either group.

Five patients in group A and 2 patients in group B had inadequate blockade and had to be supplemented with Inj. midazolam and Inj Propofol (Table 8).

DISCUSSION:

This study demonstrates that when clonidine was added to combination of lignocaine and bupivacaine and injected into the brachial plexus

Table 5: Diastolic Blood Pressure Changes.

Time	Group A	Group B	t-value	p-value
Pre-op	80.33 ± 3.56	80.23 ± 3.87	1.76	0.49
Pre-med	79.90 ± 3.17	81.14 ± 2.76	1.45	0.39
0 min	79.37 ± 3.34	81.90 ± 4.98	1.99	0.77
15 min	78.50 ± 3.78	82.01 ± 3.99	0.89	0.12
30 min	81.39 ± 3.11	80.11 ± 1.11	0.91	0.93
45 min	80.81 ± 3.19	81.43 ± 2.92	1.32	0.41
60 min	78.19 ± 3.91	81.98 ± 3.33	1.59	0.11
75 min	78.09 ± 3.45	81.39 ± 3.11	1.23	0.48
90 min	79.23 ± 3.33	80.47 ± 1.99	1.87	0.39
120 min	77.83 ± 3.39	82.61 ± 2.54	0.91	0.26
Post-op	79.61 ± 3.62	80.80 ± 2.38	0.99	0.29

Table 6: Pulse Rate Changes.

Time	Group A	Group B	t-value	p-value
Pre-op	84.7 ± 5.76	85.54 ± 8.23	0.45	0.59
Pre-med	85.5 ± 6.71	87.61 ± 5.98	0.72	0.79
0 min	85.33 ± 9.23	86.09 ± 7.12	0.81	0.38
15 min	84.09 ± 8.34	88.3 ± 6.32	0.62	0.81
30 min	83.54 ± 8.89	87.94 ± 8.92	0.79	0.67
45 min	84.5 ± 8.02	86.37 ± 7.99	1.02	0.39
60 min	84.2 ± 7.65	88.49 ± 6.57	0.49	0.62
75 min	85.7 ± 6.98	85.16 ± 7.23	0.62	0.66
90 min	83.71 ± 8.31	86.01 ± 7.56	0.78	0.91
120 min	85.45 ± 8.93	87.40 ± 8.99	0.92	0..71
Post-op	84.8 ± 7.41	87.38 ± 9.21	0.83	0.89

Table 7: Sedation Score.

Time	Group A	Group B	t-value	p-value
Pre-op	1	1	-	-
Pre-med	1	1	-	-
0 min	1	1	-	-
15 min	1	1	-	-
30 min	1	2.7 ± 0.25	23.24	<0.0001
45 min	1	2.8 ± 0.31	17.86	<0.0001
60 min	1	2.6 ± 0.41	17.66	<0.0001
75 min	1	2.7 ± 0.38	17.08	<0.0001
90 min	1	2.6 ± 0.49	23.99	<0.0001
120 min	1	2.6 ± 0.31	32.44	<0.0001
Post-op	1	2.6 ±0.32	32.93	<0.0001

sheath, it resulted in earlier sensory and motor onset and longer analgesia than when epinephrine was added. This result were similar with Goldfarb G, Ang E T, Debaene B, Delefosse D, Jolis P[17] and Bernard Jean Marc, Marcaire, Philippe[21] study where different concentrations of clonidine were used in axillary plexus block with lignocaine.

It is difficult to define the duration of analgesia, however the researchers herein relied on patient's tolerance to pain to define the end of analgesia which varied markedly among patients. Duration of analgesia suggested prolongation in clonidine group which are similar with Jean J, et al[22] study using clonidine in brachial plexus block. Their duration in clonidine group was quite longer than our group which can be explained by the difference in the clonidine dose used i.e.150µg. This is comparable with Bernard Jean Marc et al[21] study showing dose

Table 8: Adequacy of Analgesia.

Grading	Group A	Group B
Complete	25	28
Incomplete	5	2
Total Failure	-	-

dependant prolongation of analgesia, reaching a mean of 770 min for 300μg group. Bernard Jean Marc et al[21] study concluded that the best dose of clonidine to be used clinically is between 30 μg and 90 μg and the side effects of α2 agonist limits itself only to sedation in this dose which is same as with our study.

Though there was profound sedation in some patients, no episode of decrease in SpO2 was noted which suggests that 90μg to be advantageous dose as compared to higher doses used. Bernard Jean Marc et al[21] used various concentrations of clonidine and noticed fall in SpO2 levels only in 300 μg group. Clonidine did not produce any significant hemodynamic changes suggesting no side effects with use of clonidine in 90μg. This was also seen in Jean J, et al[22] study with 150 μg clonidine in brachial plexus block. Colin Mc Cartney, et al[23] review suggested that, limited side effects at doses of clonidine upto 150μg.

Bernard Jean Marc et al[21] observed significant fall in systolic blood pressure, diastolic blood pressure and pulse rate at 300 μg while in smaller doses no hemodynamic changes were noted. 5 patients in clonidine group and 2 in epinephrine group had inadequate block. This is comparable to Bernard Jean Marc et al[21] study which showed incomplete block in saline as well as clonidine groups. Clonidine produces analgesia in animals and humans via a non opiate action on the α2 receptors of the dorsal horn of the spinal cord[11]. The prolongation of the duration of analgesia by clonidine when injected at a peripheral nerve site is not understood.

Certain theories have been postulated like (a) Clonidine may interfere with the vascular resorption of local anaesthetics by producing vasoconstriction but Gaumann D[24] noticed that peak plasma concentration of lidocaine were higher and occurred earlier than in those treated with epinephrine which indicates the absence of a local vasoconstrictor effect of clonidine. (b) Clonidine may have a direct action on neural tissues, especially at spinal level. Hutschala D, et al[25] observed that duration of action of brachial plexus block got prolonged with addition of clonidine while it did not got prolonged in the group receiving intramuscular clonidine[3]. It may induce analgesia via a systemic mechanism after vascular resorption and secondary distribution to the brainstem[26].

CONCLUSION:

The Present study suggests that a small dose of clonidine produces early sensory and motor onset along with enhancement of the quality of the peripheral block from local anaesthetics and limits its α2 side effects to sedation. Also, the addition of clonidine produces longer duration of analgesia as compared to epinephrine when injected into the brachial plexus. Clonidine in smaller concentration remains an attractive option to prolong analgesia in the postoperative period under brachial plexus block. Hence, clonidine provides early onset, longer duration & minimum side effects on comparison with adrenaline in brachial plexus block.

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