Comparative Evaluation Of The Efficacy Of Dexmedetomidine And Dexamethasone As An Adjuvant To Combination Of Levobupivacaine And Lignocaine In Supraclavicular Brachial Plexus Block Using Nerve Stimulator

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Abstract: Background: Adjuvants when added to local anaesthetics hasten the onset and prolong the duration and quality of neuraxial and peripheral nerve blocks. In this prospective, observational, comparative study we compared dexmedetomidine and dexamethasone as an adjuvant to combination of levobupivacaine and lignocaine in supraclavicular brachial plexus block with respect to onset and duration of sensory and motor block, duration of analgesia and total requirement of rescue analgesics in first 24 hours. Material and Methods: 60 patients of ASA class I and II in the age group of 18 to 70 years divided in to 2 equal groups 1 and 2.Group 1 received dexmedetomidine 50µg and group 2 received dexamethasone 8mg along with levobupivacaine (0.5%) and lignocaine (2%). Results: Onset of sensory and motor blockade was14.25±4.01 min and 16.85±4.74min in group 1 and 16.11±5.49min and 20.37±4.89 in group 2.Onset of sensory blockade was statistically not significant ($p>0.05$) while onset of motor blockade was statistically highly significant($p<0.001$) between two groups. Duration of sensory and motor blockade was 586.66±88.44min and 488.88±102.89min in group 1 and 617.77±62.85min and 528.88±74.89min in group 2, respectively ($p>0.05$) Duration of post operative analgesia in group 1 was 1028.88±252.29 min while in group 2 it was 1278.29±137.70min ($p<0.001$). Conclusion: After comparing dexmedetomidine and dexamethasone we concluded that dexamethasone is better, safe and effective alternative to dexmedetomidine. [Bhajikhau K Natl J Integr Res Med, 2020; 11(2):101-106]

Key Words: Dexmedetomidine, Dexamethasone, Levobupivacaine, Supraclavicular Block

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Introduction: Although general anaesthesia continues to be used for most of the surgical procedures, regional anaesthesia has been increasing in popularity in recent years.It is because of the fact that regional anaesthesia techniques can be utilized for both operative and post-operative period as well as complications of general anaesthesia can be avoided.[1]

Supraclavicular brachial plexus block is widely employed regional nerve block to provide anaesthesia and analgesia for upper extremity surgeries. It provides a rapid, dense and predictable anaesthesia in a more consistent manner and also provides tourniquet pain relief, good muscle relaxation hence better surgeon satisfaction and post-operative analgesia.[1,2,3]

Increasing duration of local anaethetic action is desirable to prolong surgical analgesia and anaesthesia. Dexmedetomidine, an α-2 receptor agonist with α2/α1 selectivity 8 times more than that of clonidine has been reported to improve quality of intrathecal and epidural anaesthesia. It has sedative, analgesic and sympatholytic properties. It improves the quality and prolongs the duration of sensory and motor block when used as an adjuvant to local anaesthetic.[4,5,6,7] Peripheral injection of steroid is reported to influence post-operative analgesia. They produce analgesia by blocking transmission of nociceptive myelinated C- fibres and suppressing ectopic neuronal discharge. Steroids have nerve block prolonging effect.[1,3,6,7,8]

Levobupivacaine which is s (-) enantiomer of bupivacaine has favorable clinical profile and lesser cardiotoxicity when compared with racemic bupivacaine and is being favoured local anaesthetic for regional block.[4,5,8]

Material and Methods: After obtaining approval from the Instituitional ethical committee, a prospective observational comparative study was conducted on 60 patients of either sex,belonging to ASA class I and II, in the age group of 18 to 70 years, weighing 40 to 65 kg posted for upper extremity surgeries below the shoulder joint for supraclavicular brachial plexus block.

All The Patients Were Randomly Divided In To Two Equal Groups To Receive Following Drugs:

Group1: Levobupivacaine(0.5%)20 ml+Lignocaine (2%)10ml+Dexmedetomidine 50 µg (0.5ml)+ Distilled water to make 40ml total volume.

Group2: Levobupivacaine(0.5%)20 ml+Lignocaine (2%)10ml+Dexamethasone 8mg(2ml) + Distilled water to make 40ml total volume.

Patients with known allergy to local anaesthetics, uncontrolled diabetes and hypertension, coagulopathy, pre-existing peripheral neuropathy were excluded from the study.

On the day of the surgery, nil by mouth status was confirmed and informed written consent was obtained after explaining the procedure. Baseline pulse rate, systolic blood pressure and respiratory rate were measured. All the patients were premedicated with injection midazolam 1 mg intravenously.

All the patients were given supraclavicular brachial plexus block by anaesthesia resident who had at least two years of experience. The patients were placed in supine position with head turned away from the side to be blocked. The arm to be anaesthetized was abducted and the hand was extended along the side towards the ipsilateral knee. After sterile preparation, the lateral border of sternocleidomastiod muscle was identified by asking the patient to raise the head slightly which made lateral border of sternocleidomastoid muscle prominent. The palpating finger was then roll over the belly of the anterior scalene muscle into the interscalene groove, where a mark was made 1.5 to 2cm posterior to the midpoint of clavicle. Palpation of subclavian artery at this site confirms the landmark. An insulated 5cm, 22 gauge nerve stimulator needle was inserted at this point in a caudal, slightly medial and posterior direction until motor response was elicited or the first rib was encountered. In the presence of finger twitches, the current was reduced to 0.5mA from 1mA. If, twitches still persistent 40 ml drug was injected after negative aspiration.[9]

Pulse rate, systolic blood pressure, respiratory rate, oxygen saturation, sensory and motor blockade as well as sedation score were monitored every 5 min up to 30 min, then every 15 min up to 2 hrs, there after hourly up to 6 hrs, then at 8th, 10th, 12th and 24th hour.

Post operative pain was assessed by visual analogue scale (VAS). When VAS>5, injection diclofenac sodium 75 mg intramuscularly was administered as rescue analgesic, time was noted and total doses required were noted up to 24 hrs. Sensory blockade was assessed by three point sensory score. Onset of sensory blockade was taken as the time from injection of the study drug to attainment of a sensory score of 2.

Sensory blockade was graded as below:

0. Sharp Pain On Pin Prick
1. Touch Sensation On Pin Prick
2. Not Even Touch Sensation

Motor blockade was assessed by Lovett rating scale. Onset of motor blockadewas taken as the time from injection of the study drug to attainment of a motor score of 3.

Motor Blockade Was Graded As Below:

0. Complete Paralysis
1. Almost Complete Paralysis
2. Pronounced Impairment Of Mobility
3. Slightly Impaired Mobility
4. Pronounced Reduction Of Muscular Force
5. Slightly Reduced Muscular Force
6. Normal Muscular Force

Sedation Was Assessed By Ramsay Sedation Score:

1. Anxious Or Agitated Or Both
2. Co-Operative, Oriented And Tranquil
3. Following Verbal Commands
4. Asleep With Brisk Response To Light Stimulation
5. Asleep With Sluggish Response To Light Stimulation
6. Asleep With No Response To Stimulation

Quality Of Block Assessed During Intraoperative Period:

Satisfactory Block: Surgery completed without patient discomfort or need for supplementation.

Unsatisfactory Block: A sensory region involved in the surgery was not completely anaesthetized and needed ketamine bolus 0.5mg/kg intra - venously.

Complete Failure: General anaesthesia was given by attending anaesthesiologist using his/her preferred technique. These patients were included in the study.

Post operative pain was assessed by visual analogue scale (VAS). VAS score was noted immediately after surgery, every hourly up to 6 hours then at 10^{th}, 12^{th} , 18^{th} and 24^{th}hour.When VAS>5, injection diclofenac sodium 75 mg intramuscularly was administered as rescue analgesic, time was noted and total doses required were noted up to 24 hours. Duration of sensory blockade was defined as the time from

onset of sensory block to the time when patient again developed sharp pain to pin prick.Duration of motor blockade was defined as the time from onset of complete motor block to the restoration of normal muscular force.

Complications and side effects like systemic toxicity, hypotension, bradycardia, nausea, vomiting, respiratory depression, neuropathy, hyperglycemia, pneumothorax, infection at the site of injection were noted. Random blood sugar(RBS) was checked at 2 hours and 24 hours postoperatively.

Statistical Analysis: The data collected was entered into a database Microsoft excel sheet. The results were expressed as mean ± standard deviation. The statistical analysis was done using EPI software version 2.3 using the "two tailed students' t test". The difference was considered to be statistically significant when P value < 0.05 and highly significant when P<0.001.

Results: Out of 60 patients, 3 patients in either group required general anaesthesia. These patients were included in the study; therefore statistical analysis of 27 patients was done in either group. (N=27)Age, Gender, Weight, Height And Duration Of Surgery Was Comparable In Both The Groups. (P>0.05)

Table 1: Sensory And Motor Blockade Onset, Duration And Postoperative Analgesia

	Group 1 Mean±SD	Group 2 Mean±SD	P value
Onset Of Sensory Block	14.25±4.01	16.11±5.49	>0.05
Onset Of Motor Block	16.85±4.74	20.37±4.89	<0.001
Duration Of Sensory Block	586.66±88.44	617.77±62.85	>0.05
Duration Of Motor Block	488.88±102.89	528.88±74.89	>0.05
Duration Of Post Opanalgesia	1028.88±252.29	1278.14±137.70	<0.001

VAS score was lower in group 2 compared to group 1.

Figure: 1 Duration Of Post Operative Analgesia.

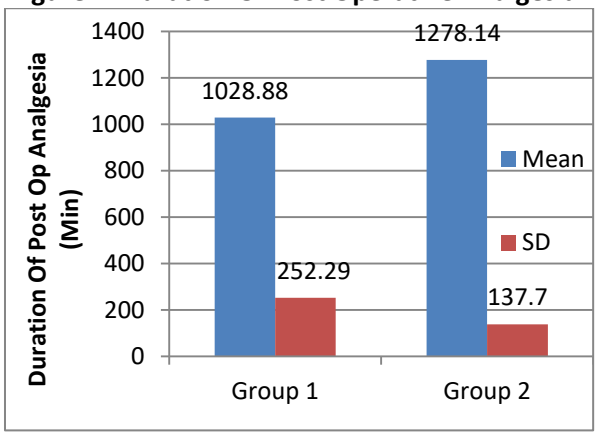


Table 2: No. Of Analgesic Doses Required In First 24 Hours Post Operatively

Number Of Injections	Group 1		Group 2	
	No.	%	No.	%
0	2	7.41	10	37.04
1	18	66.67	17	62.96
2	7	25.92	0	0
Mean	1.18		0.62	
SD	0.54		0.48	
'P' Value	<0.0001			

Figure: 2 VAS Score

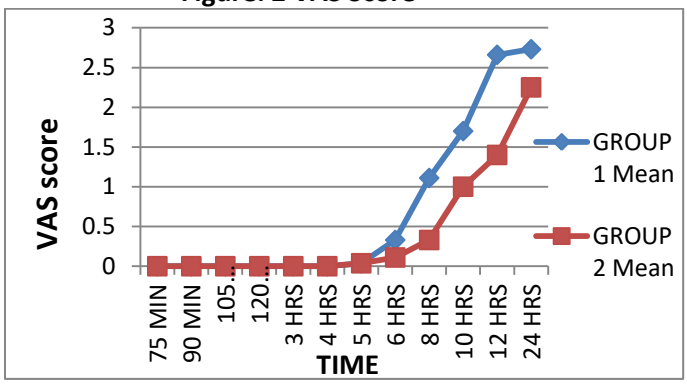
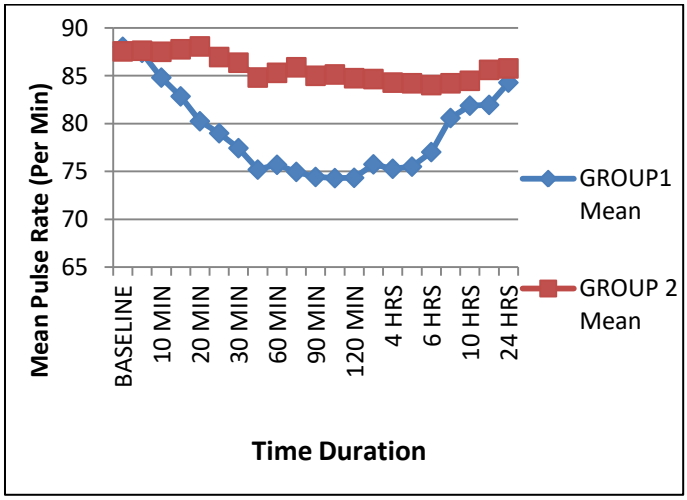


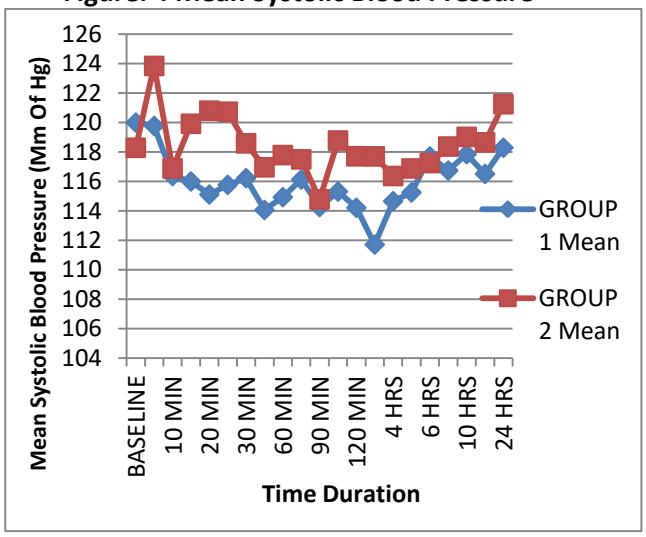
Figure: 3 Mean Pulse Rate



A decrease in mean pulse rate from baseline was observed in both groups, which was more in group 1 throughout the observation period. The difference in the mean pulse rate was statistically significant in group 1 from 20 min to 30 min and at 60 min($p<0.05$) , while it was highly significant at 45 min and from 90 min to 6 hours after giving block($p<0.001$).

The difference in the blood pressure between the two group was statistically insignificant ($p>0.05$) throughout the observation period.

Figure: 4 Mean Systolic Blood Pressure



The mean RBS at baseline, at 2 hours and 24 hours was higher in group 2 compared to group 1 but the difference was statistically insignificant ($p<0.05$).

In group 1, 86.67% patients obtained satisfactory block, 3.33% patient required injection ketamine analgesic dose while 10% patients required general anaesthesia. While in group 2, 76.67% patients obtained satisfactory block, 13.33% patients required ketamine analgesic dose while 10% patients required general anaesthesia.

Sedation score in group 1 was statistically significant ($p<0.05$) at 5 and 10 min and also at 3 hours while it was statistically highly significant ($p<0.001$) from 15 min to 2 hours after giving block. No side effects such as nausea, vomiting, hypotension, bradycardia, respiratory depression, pneumothorax, hyperglycemia or nerve palsy was observed in the patients of either group.

Discussion: In the present study we compared dexmedetomidine and dexamethasone as an adjuvant to levobupivacaine, and found that dexamethasone significantly prolongs duration of postoperative analgesia compared to dexmedetomidine without any adverse effects.

Dexmedetomidine is α-2 selective agonist with α2:α1 binding selective ratio of 1620:1 as compared to 220:1 for clonidine, thus decreasing unwanted side effects of α-1 receptor. Highest density of α2 receptors is located in locus coeruleus in CNS.[5,6,7,10]

Steroids are very potent anti-inflammatory and immunosuppressive agents. Perineural injection of steroid is reported to influence post-operative analgesia. Various steroids have been used for this purpose, but dexamethasone, a synthetic glucocorticoid derivative is preferred because of its highly potent anti-inflammatory property, about 25 to 30 times more potent than hydrocortisone and without any mineralocorticoid activity.[3,6,7,11]

Verma Niranjan Kumar et al[7] used 50µg dexmedetomidine and 8 mg dexamethasone along with 0.5% ropivacaine 30ml and observed that onset of sensory and motor block was onset of sensory and motor blockade was faster and duration of sensory and motor blockade was prolonged in dexmedetomidine group compared to dexamethasone group($p<0.05$).

Lee Myeong Jong et al[6] used 100µg dexmedetomidine and 10 mg dexamethasone along with 0.5% ropivacaine 22ml and observed that there was no significant difference between onset and duration of sensory blockade between the two groups.

Kaur Haramritpal et al[4] used 1µg/kg dexmedetomidine along with 0.25% levobupivacaine 40ml and observed that onset of sensory and motor blockade was faster while duration of sensory and motor blockade was longer in dexmedetomidine group($p<0.05$).

Pathak Dr. R.G. et al[1] used 8 mg dexamethasone along with 0.5% bupivacaine 38ml and observed that the time for onset of sensory and motor blockade was faster and duration of sensory and motor blockade was prolonged in dexamethasone group($p<0.05$).

Verma Niranjan Kumar et al[7] observed significantly lower VAS score from 6th hour onwards in dexmedetomidine group compared to

dexamethasone group and duration of analgesia was significantly longer in dexmedetomidine group compared to dexamethasone group ($p<0.001$).

Kaur Haramritpal et al[4] observed that duration of analgesia was longer in dexmedetomidine compared to levobupivacaine alone group ($p<0.05$)

Pathak Dr. R.G. et al[1] observed that mean duration of analgesia in dexamethasone group was longer compared to bupivacaine alone ($p<0.001$).

Dexamethasone improves the quality and duration of peripheral nerve block. This is mediated by attenuation of the inflammatory mediators, reduction of ectopic neuronal discharge, and inhibition of potassium channel mediated discharge of nociceptive C- fibers.[3]

Verma Niranjan Kumar et al[7] observed that heart rate and mean arterial blood pressure was comparable between dexmedetomidine and dexamethasone group without any statistically significant difference however the pulse rate was slightly lower in dexmedetomidine group.

Kaur Haramritpal et al[4] observed that systolic and diastolic blood pressure were significantly lower and incidence of bradycardia in 2 patients in dexmedetomidine group but none of them required any treatment.

Limitations: Biochemical analysis of the blood concentration of levobupivacaine, dexmedeto-midine and dexamethasone was not done due to nonavailability of facilities at our institution**.**

Conclusion: After comparing the efficacy of dexmedetomidine and dexamethasone as an adjuvant to levobupivacaine and lignocaine for supraclavicular brachial plexus block we have concluded that dexamethasone is a better, safe and effective alternative to dexmedetomidine.

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