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A COMPARISON OF ANESTHETIC EFFICACY OF NALBUPHINE AND DEXMEDETOMIDINE AS ADJUVANTS TO 0.5% ROPIVACAINE AND 2% LIGNOCAINE FOR SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN UPPER LIMB SURGERIES

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ABSTRACT

Background: Anaesthetic Efficacy of Nalbuphine And Dexmedetomidine as an Adjuvant to 0.5% Ropivacaine & 2% Lignocaine for Supraclavicular Brachial Plexus Block **Aim:** A Comparison of Anaesthetic Efficacy of Nalbuphine And Dexmedetomidine as an Adjuvant to 0.5% Ropivacaine & 2% Lignocaine for Supraclavicular Brachial Plexus Block in Upper Limb Surgeries. **Methods:** After obtaining ethics committee approval and written, informed valid consent, 100 patients were enrolled in the study. The patients of either sex, ASA grade 1 and 2, Age 18- 60 years. All the patients posted for elective upper extremity surgeries below the shoulder joint and received block of Brachial plexus by a Supraclavicular technique. Group D: 50 mcg of Dexmedetomidine (0.5ml of Dexmedetomidine and diluted with 0.5 ml sterile water) and 20ml of [100mg] 0.5% Ropivacaine with [200mg] 10 ml of Lignocaine Group N: Nalbuphine (1 ml)-10 mg with 20 ml [100mg] 0.5% Ropivacaine, [200mg] 10 ml of Lignocaine. **Results:** Randomised controlled study was done by comparing Dexmedetomidine & Nalbuphine effects on the Brachial plexus block along with 0.5% Ropivacaine & 2% Lidocaine.

- A group of 100 patients were divided into 2 groups of 50 each, group D & group N.
- Group D received 50 mcg Dexmedetomidine along with 20 ml 0.5% Ropivacaine & 10 ml 2% Lidocaine.
- Group N received 10 mg Nalbuphine along with 20 ml 0.5% Ropivacaine & 2% Lignocaine.
- For Brachial plexus block, classical landmark based approach is followed.
- Onset time of Sensory block, Motor block, duration of Sensory & Motor block, level of sedation & Hemodynamic parameters observed.
- With the observational parameters, 't' test applied and the sensory blockade onset time, faster onset of Motor blockade seen in D group were statistically significant.
- Duration of Sensory block, Motor block also prolonged in D group was statistically significant.
- Time for rescue analgesia prolonged in D group is statistically significant.

Conclusion: By the observations from the study, by adding Dexmedetomidine 50 mcg compared to Nalbuphine 10mg with 0.5% Ropivacaine & 2% Lidocaine in Supraclavicular Brachial plexus block resulted in

- Faster onset of Sensory block.
- Faster onset of Motor block.
- Prolonged duration of Sensory block.
- Prolonged duration of Motor block.
- Better Sedation intraoperatively.
- No significant hemodynamic effects & adverse effects
- Though Nalbuphine also was a good adjuvant, it had added benefit of low cost making it more economical for use.

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INTRODUCTION

The most popular method for upper limb surgical procedures, Brachial plexus block is the most commonly used method as an alternative to and along with general anaesthesia to provide ideal surgical environment by providing appropriate muscular relaxation, maintaining stable intraoperative hemodynamics, and better sympathetic block.

Its advantages are safety margin, effective postoperative analgesia. Interscalene, supraclavicular, infraclavicular, and axillary brachial plexus blocks have all been described, but Supraclavicular block is the simple to administer.

One of the most commonly used amide local anesthetics is Ropivacaine because it is having a long active time of 6 to 9 hours, with few side effects than other amide local anesthetics, particularly Bupivacaine.

Various drugs, including as Neostigmine, Midazolam, Fentanyl, Dexmedetomidine, Clonidine, Dexamethasone, Buprenorphine and others, are mixed with local anesthetics to enhance the quality of blockage and increase duration of action, as well as to provide postoperative analgesia.

Alpha₂agonist Dexmedetomidine is mostly used in conjunction with regional anaesthetic. It enhances the duration of local anaesthetic action to greater than ten hours.

Nalbuphine is recently being used opioid agonist-antagonist. It increases the duration of regional blocks to as long as 10 hours. Unlike other opioids, Nalbuphine has got ceiling effect. In cost wise it is more economical.

AIM & OBJECTIVES

Aim is to compare the efficacy of Nalbuphine & Dexmedetomidine used as adjuvants to Lignocaine and Ropivacaine in elective upper limb surgical procedures using Supraclavicular Brachial plexus block.

- Primary objective is comparison of
- onset of the Sensory blockade
- onset of the Motor blockade
- duration of the Motor blockade
- duration of the Sensory blockade
- duration of analgesia & time for Rescue analgesia

Second objective is to compare the side effects in the two groups and the level of sedation experienced by the patients.

MATERIALS AND METHODS

Source of Data

This study was carried out in the Department of Anesthesiology, Government General Hospital, Siddhartha medical college, Vijayawada. The study was approved by the local ethical committee. The protocol of the study was reviewed and approved by the Dr YSR University of health sciences, Vijayawada, Andhrapradesh, India.

Method of Collection Data

After obtaining approval from the hospital academic and ethics committee and written, informed valid consent, 100 patients were enrolled in the study. The study population included patients of either sex, ASA grade 1 and 2 Age 18- 60 years. All individuals were posted for elective upper extremity surgeries

below the shoulder joint and received block of Brachial plexus by a Supraclavicular technique.

Study design: The study was a prospective, randomized case-control study.

Study period: January 2022 to November 2023.

Inclusion Criteria

- Age group 18– 60 years of either sex
- Patients undergoing upper limb surgeries below the shoulder joint
- ASA grade I and II
- Exclusion Criteria
- Patients who are not given Consent, ASA grade 3 & 4
- Any bleeding diathesis and patient on anticoagulants
- Severe respiratory disease
- Neurodeficit involving Brachial plexus
- Injection site infection
- Signs of allergy to local anesthetic test dose & history of allergy to local anesthetics
- pregnant & lactating mothers.

Investigations

- complete blood picture, serum creatinine & blood sugar, x ray chest, if age >45 years - ECG, Bleeding and clotting time

PATIENTS ARE DIVIDED INTO TWO GROUPS

GROUP D: 50 mcg of Dexmedetomidine (0.5ml of Dexmedetomidine and diluted with 0.5 ml sterile water) and 20ml of [100mg] 0.5% Ropivacaine with [200mg] 10 ml of Lignocaine-31 ml

GROUP N: Nalbuphine (1 ml)-10 mg with 20 ml [100mg] 0.5% Ropivacaine, [200mg] 10 ml of Lignocaine-31 ml

Monitoring: standard monitors were attached

- Pulse probe for saturation [spO₂]
- ECG for heart rate & rhythm
- NIBP for blood pressure recordings
- An intravenous drip started before starting the procedure. Vital parameters checked throughout the procedure & recorded. O₂ @ 6 lit/min supplemented through oxygen mask.

Instruments:

- Sterile gloves
- Antiseptic solution for disinfection
- Sterile gauze pieces, one sterile towel with centre hole
- Two 10 ml syringes for local anesthetic solution
- One 1 ml syringe with 22G needle for skin infiltration.
- One 5-cm, short beveled, 22-G needle
- Two sterile vessels for iodine scrub and spirit.

METHODOLOGY

TECHNIQUE- Brachial plexus block Supraclavicular technique (landmark based technique)

1. Patient position is supine position with head end of the bed elevated to 30 degree without a pillow & was explained to inform whether any paraesthesia is experienced during needle insertion for the block.

Arms placed by the side and asked to turn head to opposite side to be blocked. Small pillow is placed below shoulder in between the two scapulas.

2. Patient is asked to lie flat & relax the shoulders. Area of the neck, painted and draped with sterile linen.
3. The operator should stand on the side to be blocked. subclavian pulsations should be felt with one hand and needle to be inserted with other hand [usually dominant hand].
4. The Sternocleidomastoid (SCM) muscle's posterior border was detected and tracked distally to the clavicle's point of attachment.
5. The needle entry position is about 2.5 cm lateral to the insertion of Sternocleidomastoid on to clavicle. Palpating the subclavian artery pulsation at the spot confirms the landmark. This is where the palpating index finger should be positioned.
6. 1 ml of 1% lignocaine skin infiltration given.
7. A 22G needle is introduced perpendicular to the skin, lateral to subclavian pulsations.
8. Patient is asked for paraesthesia [tingling & shock like sensation] in the area of the elbow, forearm which is radiating to hand. If response is came continue the procedure.
9. If an acceptable response was not obtained, the needle was removed and the penetration angle modified in the anteroposterior plane. The total volume of the medication was injected in 5 ml increments, each preceded by negative aspiration. A three-minute massage was given to ensure that the drugs were distributed uniformly.

The pinprick method is used to ascertain the adequacy of sensory blockage. Anaesthesia was attained, and the surgery was allowed to proceed

BLOCKEVALUATION

Sensory and Motor blockage is examined soon after the patient is positioned supine.

Sensory onset was determined by pricking the elbow and forearm with a blunt needle on both the flexor and extensor aspects.

Sensory Blockade duration was taken from time of onset of sensory blockade at the elbow until pain felt at the elbow with pin prick by the needle.

Sensory block duration was taken from the time patient feels no painsensation at elbow&forearm to the time, patient feels pain or need for rescue analgesia.

Motor Block onset with the help of a modified LOVETT rating scale, the onset of Motor block was graded on a scale of 6 (normal muscular force) to 0 (total paralysis) based on thumb movements.

Motor block duration

Was taken from the time the patient cannot move his thumb to the time when patient moves his thumb in all directions.

Heart rate and NIBP recordings documented prior to the start of the procedure and at various intervals after the procedure. Post op Blood pressure and Heart rate measured every 3 hrs until 24 hrs.

Pasero-opioid induced sedation scale (POSS)-to observe sedation level in patients

RESULTS

This prospective randomized controlled double-blind study was conducted in 100 patients of both sexes with ASA Grade 1 & 2, aged between 18-60 years, posted for elective upper limb surgeries. Patients were randomly divided using slips in the box technique into 2 groups.

Group-D includes patients who are given 50 mcg of Dexmedetomidine added to 20 ml of 0.5% Ropivacaine & 2% Lidocaine 10 ml in Supraclavicular brachial plexus block.

Group-N includes patients who are given 10 mg Nalbuphine with 20 ml of 0.5% Ropivacaine & 2% Lidocaine 10 ml in Supraclavicular brachial plexus block.

Age distribution

Age group 18-60 yrs. Mean age group of the population was 36.78±12.75 yrs in group N & 40.24±9.21 yrs in group D. With use of ‘t’ test ,obtained a P value of 0.123., which was statistically insignificant, thus both groups can be compared in terms of age.

Sex Distribution of study population

Patients of both sex were randomly selected. Dexmedetomidine group had 29 males & 21 females. Nalbuphine group had 26males&24females.Totalratioofmale:femalewas11:9.Hence both can be compared in terms of sex ratio.

Weight of Patients

Group	Mean	SD	t-value	P-value
Nalbuphine	69.26	.881		
Dexmedetomidine	67.46	.976	1.209	0.229

The mean weight in Dexmedetomidine group was 67.46±6.97 kg and in Nalbuphine group was 69.26±7.88 kg .By using ‘t’ test P value was 0.229, that was statistically insignificant.

Distribution of Surgery

In the Nalbuphine group, 26% of humerus surgeries and 70% of radius and ulna surgeries. In the Dexmedetomidine group, 40% of humerus cases and 56% of forearm cases.

Sensory blockade onset (Minutes)

Group	Mean	SD	t-value	DF	P-value
Nalbuphine	10.697	1.02122			
Dexmedetomidine	5.02	0.9256	29.125	98	<0.001

Meantime for Sensory blockade onset was 10.69±1.02minutes in N group and 5.02±0.92 minutes in D group. There was statistically significant difference in onset of Sensory blockade between two groups [p<0.001]

Motor Blockade onset (Minutes)

Group	Mean	SD	t-value	DF	P-value
Nalbuphine	15.115	1.49763			
Dexmedetomidine	10.1	0.93678	20.075	98	<0.001

Mean time of Motor blockade onset in D group was 10.1±0.93 minutes and in N group was 15.1±1.49 minutes. There is a statistically significant difference between these two groups [p<0.001].

Duration of Motor Block (Hours)

Group	Mean	SD	t-value	D F	P-value
Nalbuphine	9.215	0.88354			
Dexmedetomidine	17.242	19.67672	-2.882	98	0.005

MeandurationofmotorblockinDexmedetomidinesetwas17.24±19.67hoursandin Nalbuphine set was 9.21±0.88 hours. There was a statistical significance between the two groups [p=0.005]

Mean Duration of Sensory Blockade (Hours)

Group	Mean	SD	t-value	DF	P-value
Nalbuphine	7.36	0.7287			
			-2.508	98	0.014
Dexmedetomidine	7.68	0.5322			

MeandurationofsensoryblockinDexmedetomidinegroupwas7.68±0.5322hoursand inNalbuphinegroupwas7.36±0.72hours.Using‘t’testPvalueobtained0.014, that is statistically significant.

Time for Rescue Analgesia (Hours)

Group	Mean	SD	t-value	DF	P-value
Nalbuphine	10.04	0.8197	-23.37	98	<0.001
Dexmedetomidine	14.48	1.0641	4		

Meantime for rescue analgesia observed in the Dexmedetomidine group was 14.48±1.06 hours, and in the Nalbuphine group was 10.04±0.81 hours. Obtained a P-value < 0.001, that is statistically significant

Peripheral nerve blocks are a type of Regional anaesthesia. The anesthetic is injected near a specific nerve or bundle of nerves to block sensations of pain from a specific area of the body. Nerve blocks usually last longer than local anesthesia. They are most commonly used for surgery on the arms and hands, the legs and feet, or the face.

The Supraclavicular block is one of several techniques used to anesthetize the Brachial plexus. The block is carried out at the level of the Brachial plexus trunks where almost the entire Sensory, Motor, and sympathetic innervation of the upper extremity is carried in just three nerve structures confined to a very small surface area. Consequently, this technique typically provides a predictable dense block with rapid onset. The Supraclavicular block provides anesthesia and analgesia to the forearm, hand & arm below the shoulder. It is an excellent choice for elbow and hand surgery. A combination of local anaesthetics is commonly used to conduct a Brachial plexus block. In this trial, Ropivacaine, with a benefit of lower cardiotoxicity was utilised.

When used as an adjuvant, Dexmedetomidine, an alpha 2 agonist not only decreases the time of onset of the block but also increases the duration of both Sensory blockade & Motor blockade along with providing analgesia. It works best as a sedative that doesn't decrease respiratory drive. It works by depressing noradrenergic neuronal activity in pons leading to an increase in operational GABA neurons in the ventrolateral pre optic nucleus. Thereby leading to a block of pain pathway. Initially activation of alpha 2b receptors causes a brief elevation in blood pressure.

Variation in Heart Rate (Beats per Min)

Heart Rate	Nalbuphine		Dexmedetomidine		t-value	DF	P-value
	Mean	SD	Mean	SD			
Baseline	73.23	7.23	74.92	7.679	1.127	98	0.2625
5mins	65.94	9.989	69.52	6.119	-2.161	98	0.33
15mins	63.3	9.054	65.76	5.988	-1.602	98	0.112
30mins	59.88	6.802	59.54	4.464	0.295	98	0.768
1HR	58.8	6.55	57.5	4.892	1.124	98	0.264
2HR	59.5	6.208	53.22	4.254	5.901	98	<0.001**
4HR	59.7	5.515	50.92	4.198	8.957	98	<0.001**
6HR	60.62	6.318	51.1	4.186	8.883	98	<0.001**
8HR	74.06	5.622	52.78	3.394	22.91	98	<0.001**

Mean heart rate in the Dexmedetomidine group was 59.54±4.464 min, and in the Nalbuphine group was 63.3±9.05 min. From after 60 min, the heart rate variation in both groups is statistically significant with a P-value < 0.001.

Sedation Score

Group	Mean	SD	t-value	DF	P-value
Nalbuphine	2	0.03			
Dexmedetomidine	2.32	0.471	-4.802	98	<0.001

In the Dexmedetomidine group, the sedation score was 2.32±0.471, whereas the score in the Nalbuphine group was 2±0.03. A P-value of 0.001 makes it statistically significant

Mean distribution of MAP (mmHg)

After 60 minutes, the variation of mean arterial pressure (MAP) in both groups obtained a P-value < 0.001, thus statistically significant

Sedation and analgesia are because of activation of alpha 2a receptors. Nalbuphine is an opioid that acts as both a kappa agonist and a mu antagonist. Because of its affinity for kappa receptors, it has analgesic and sedative properties. It has cardiovascular stability, and it has a ceiling effect on respiratory depression, making it better than other opiates.

In present randomized double blinded, prospective study. Study comprised of 100 patients posted for upper limb surgeries below the shoulder joint were given Brachial plexus block, Supraclavicular technique using nerve stimulation technique. The patients were divided in to two groups by using the procedure of randomization.

GroupN: Nalbuphineand
GroupD: Dexmedetomidine

DISCUSSION

Age: In the present study we found maximum patients from age group of 31 – 50 years from both the groups. Mean age of the patients from Group N was 30-60 years with the SD of 12-75 years that of in Group D it was 40-24 years with the SD of 9-12 years and this mean difference was statistically insignificant (**p-value** : 0.123).

Gender: Group N male to female ratio was 13:12 that of in Group D it was 29.: 21.

Weight: Present study observed no significance difference in the mean weight between the groups.

Onset of Sensory Block

We have observed in our study that mean onset time of sensory block was in Group N was 10.69 minutes with standard deviation of 1.02 minutes and that of in Group D it was 5.02 Minutes with standard deviation of 0.92 Minutes and this difference of time for onset between the group was statistically significant. Thus Group D has early sensory block onset compared to Group N.

Onset of Motor Block

In my investigation, the mean onset of Motor blockage in the Nalbuphine group was 15.11±1.49 minutes, which was much longer than the 10.1±0.93 minutes in the Dexmedetomidine group, and this difference was statistically significant (P-value0.01).

Duration of Sensory Block

Sensory block lasted 7.68 ± 0.53 hours in the Dexmedetomidine group and 7.36 ±0.72 hours in the Nalbuphine group.

Duration of Motor Block

The average duration of Motor Block in our study was 17.244± 19.67 hours in the Dexmedetomidine group and 9.214± 0.88 hours in the Nalbuphine group. P value <0.05 which was statistically significant.

Mean Duration of Analgesia

The mean duration of analgesia was more in Dexmedetomidine group significantly, 18.23±5.36 hours compared to Nalbuphine group 10.21±0.75 hours, Which was statistically significant.

Time of Rescue Analgesia

Time of Rescue analgesia was substantially longer in the Dexmedetomidine group (14.53±1.07 hours) than in the Nalbuphine group (10.13±0.81 hours)and this difference of mean time for rescue analgesia was statistically significant

Hemo dynamical Changes

Our research found that initially there was no statistically significant change in Heart rate and Mean arterial pressure between the groups. After 1 hour, throughout the surgery, Heart rate and Mean arterial pressure were lower with Dexmedetomidine than Nalbuphine.

Adverse Effect

In our study we have not observed any adverse effect like hypotension, bradycardia, nausea, vomiting, in both the groups. Both Nalbuphine and Dexmedetomidine were shown to be good adjuvants in this trial, with no major adverse effects and with steady hemodynamics.

Sedation Score

In our study sedation in the two groups obtained a mean score of 2.30 ± 0.36 in Dexmedetomidine group and mean of 2.10± 0.052 in Nalbuphine, which is a significant difference statistically. Dexmedetomidine's central effects appear to play a role in the extension of sensory and motor block duration. In our investigation, Dexmedetomidine intravenous infusion significantly increased brachial plexus block duration compared to the Nalbuphine group.

CONCLUSION

By the observations from the study, by adding Dexmedetomidine 50 mcg compared to Nalbuphine 10 mg with 0.5% Ropivacaine & 2% lidocaine in Supraclavicular brachial plexus block resulted in:

- Faster onset of sensory block.
- Faster onset of motor block.
- Prolonged duration of sensory block.
- Prolonged duration of motor block.
- Better sedation intraoperatively.
- No significant hemodynamic effects & adverse effects.

Nalbuphine also was a good adjuvant; it had the added benefit of low cost, making it more economical for use.

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