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Original Research Article

A Comparative study between 0.5% Ropivacaine with clonidine (1mcg/Kg) versus 0.5% Ropivacaine with dexmedetomidine (1mcg/Kg) by Ultra sound guided supraclavicular brachial plexus block

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ABSTRACT

BACKGROUND: Regional anaesthesia is very effective and successful when compared to general anaesthesia however with few limitations. Ropivacaine is common anesthetic drug used. To overcome the limitations, adjuvants like clonidine and dexmedetomidine have been studied with various anesthetic drugs.
METHODS: Prospective comparative study on 90 patients ASA grade one and 2, falling between age group of 18 to 60 years with weight range of 50 to 60 kgs who were undergoing surgeries at lower arm, elbow and hand were randomly divided into two categories with simple randomization after obtaining written informed consent. Pinprick test 3 point scale used to assess sensory block and Modified Bromage score to assess motor blcok. Visual Analogue Score to assess analgesia.
RESULTS: Mean(SD) age in Group A is 35(SD=15.5) and Group B is 37 (SD= 11.7) years. 18 (40%) were Female and 27 (60%) were Male with sex ratio M:F = 1: 0.7 in group A and 14 (31.1%) were Female and 31 (68.9%) were Male with sex ration M:F = 1:0.5 in group B. Statistically significant group differences were seen in sensory onset, motor onset, sensory block duration, motor block duration and analgesia duration.
CONCLUSION: The study concluded that dexmedetomidine is a better alternative to clonidine to obtain early onset and prolonged duration of sensory and motor block and postoperative analgesia.

INTRODUCTION

Regional anaesthesia is very effective and successful when compared to general anaesthesia in easing pain during and after procedures. This technique delivers significant benefits including excellent pain control, reduced side- effects, and shortened stay in the post anaesthesia care unit. Because of the advent of ultrasound scanning techniques, even patient in ASA grade 3 and 4 can be taken up for surgery safely. Furthermore, with the practice of adjuvants in brachial

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE11, 2024

plexus block, it can lengthen patient care in the form of prolonged postoperative analgesia, and early mobilization of patient with stable haemodynamic variables.[1]

Brachial plexus block is one of the most commonly administered blocks because it offers almost complete anaesthesia and analgesia for surgeries of the upper extremities. For brachial plexus block supraclavicular approach which is carried out at the level of trunks of brachial plexus gives most effective block for entire upper extremity distal to arm, including lower arm , forearm and wrist.[1]
Ropivacaine is a long-acting amide local anaesthetic with greater degree of motor to sensory differentiation, reduced lipophilicity. Hence, decreased potential for central nervous system toxicity and cardiotoxicity.[2]
So, in the present study, ropivacaine will be used as local anaesthetic. To overcome the limitations, adjuvants like dexmedetomidine and clonidine will be used as adjuvant to prolong the duration of block and postoperative analgesia. Clonidine is an α_2 agonist. Although it had been used originally as an anti-hypertensive agent, it has sedative, sympatholytic and analgesic property.[3]

Dexmedetomidine is a selective α_2 adrenergic agonist. numerous studies have shown that dexmedetomidine prolongs the duration of sensory and motor block and provides very good analgesia when used as an adjuvant to local anaesthetics for nerve blocks and may also cause side effects like bradycardia, hypotension, sedation.[4,5]
However, few studies showed there are some limitations like delayed onset of action, patchy or incomplete analgesia etc. Various methods had been practised to overcome this limitation like using higher volume of local anaesthetics with limited success as it may increase the risk of local anaesthetic toxicity.[6]

Successful brachial plexus block depends on proper nerve localization, needle placement, local anaesthetic injection i.e., right drug, right dose, placed in right place, by the right technique. Traditional landmark approach and elicitation of paraesthesia necessitates multiple attempts, resulting in procedure related complications such as pain, injury to blood vessels and pneumothorax. Ultrasound guided supraclavicular brachial plexus block has become popular currently, owning to detection of anatomical variation of brachial plexus, accuracy of needle placements and avoidance of needle related complications such as injury to blood vessels, pneumothorax, and local anaesthetic toxicity[6 7].
Previous studies which compared Clonidine and dexmedetomidine as a joint for the anaesthetic agent found that dexmedetomidine was more efficacious in enhancing the block when compared to Clonidine. It was seen in dexmedetomidine group that the main duration of sensory and motor block and analgesia where higher significantly however swami et al showed that motor block onset was faster in clonidine group.[8]

It would be beneficial for both anaesthetists and patients to know which adjuvant works better for them based on the duration of surgery and the need for analgesia and motor and sensory blocks hence this study was taken up add to the existing evidence and compare the adjuvants clonidine and dexmedetomidine.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE11, 2024

MATERIALS AND METHODS

This is a prospective comparative study conducted in District Hospital, Tumkur Karnataka for a period of one year after obtaining institutional ethical committee clearance with the objective to compare Clonidine (1mcg/kg) and dexmedetomidine (1mcg/kg) as adjuvants with ropivacaine (0. 5%) as anaesthetic agent in regional anaesthesia used in upper hand surgeries. The sample size was calculated to be 90. 90 patients ASA grade one and 2, falling between age group of 18 to 60 years with weight range of 50 to 60 kgs who were undergoing surgeries at lower arm, elbow and hand were randomly divided into two categories with simple randomization after obtaining written informed consent. patients with bleeding disorder or on anti-coagulants or with neurological deficits at brachial plexus or with history of allergy to drugs or with local infection at the site of injection were excluded from the study. The two groups were as follows.

Group A: 20ml of 0.5% Ropivacaine with dexmedetomidine (1mcg) in 2ml of distilled water.
Group B: 20ml of 0.5% Ropivacaine with clonidine (1mcg) in 2ml of distilled water.

Pre-anaesthetic check-up was performed for all the patients which included a detailed history, general physical examination, and systemic examination. Basic investigations such as complete blood counts, bleeding time, clotting time, PT, APTT, INR, random blood sugar, blood urea, serum creatinine, ECG. Patients were kept nil per oral overnight.
On arrival of the patient in the operating room, baseline heart rate, blood pressure and oxygen saturation were recorded. An intravenous line secured, and IV premedications given.
Written informed consent was obtained from the patient before the block was given. the preparation for the technique involves checking the anaesthesia machine and the availability of resuscitation equipment, laryngoscope, endotracheal tube gum elastic bougies emergency drugs such as adrenaline, atropine, midazolam, dopamine, dobutamine and thiopentone and ultrasound machine and probe and the other monitoring devices.
Sterile bowl, Sterile drape sheet, Pair of sterile gloves, Betadine solution, Sterile transparent sheet to cover ultrasound probe, Sterile jelly, Local anaesthetic agent, Syringes, 23 gauges and Drugs , 20ml of 0.5%Ropivacaine, Clonidine 2 ml(60mcg), Dexmedetomidine 2ml(60mcg) are kept ready for the procedure.

Patient in supine position on table with arm by side. Head turned to opposite side. Using high frequency (7.5MHz) Ultrasound transducer, needle advancement is done.
After positioning, skin preparation done with betadine and draped. Transducer was placed in coronal plane just above the clavicle at midline (landmark-subclavian artery, scalenus muscle, first rib). Scanned for subclavian artery : Artery is hypoechoic, with visible pulsations on hyperechoic first rib . Brachial plexus is situated lateral and superior to the artery, like bunch of grapes. In plane technique, needle placed lateral to medial towards and underneath transducer. Local anaesthetic injected; plexus separate away.
Sensory block assessed using pinprick test and motor block evaluated every 2minutes until 30 minutes after injection.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE11, 2024

Pinprick test 3 point scale[9]

- 0 – Normal sensation
- 1 – Loss of sensation of pinprick (analgesia)
- 2 – loss of sensation of touch (anaesthesia)

Modified Bromage score[10]

- Activity Score
- Able to lift legs against gravity - 0
- Able to flex knee but unable to flex legs- 1
- Able to move feet but unable to flex knee-2
- Unable to move any joints- 3

Onset time of sensory block defined as the time interval between the end of total local anaesthetic administration and complete sensory block. Duration of sensory block was defined as the time interval between end of local anaesthetic administration and complete resolution of anaesthesia on all nerves.

Onset of motor block defined as the time interval between the end of local anaesthetic administration and complete motor block. Duration of motor block is defined as time interval between end of local anaesthetic administration and complete resolution of motor block.

Heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP) and saturation of oxygen (SpO_2) will be recorded every 5 minutes till completion of surgery.

Adverse effects associated with the procedure like pneumothorax, bleeding, hypotension (20% decrease in relation to baseline) and bradycardia (heart rate< 50 beats per minute) will be corrected with appropriate measures. Duration of motor, sensory blockade after surgery will be recorded. Post-operative pain will be assessed using visual analogue scale.

Rescue analgesia diclofenac sodium 75mg IM will be given when patient visual analogue score is >5.

Visual Analogue Score[11]:

- 0 : Patients does not complaining of pain
- 1-3 : Patient complaining of mild pain
- 4-6 : Patients complaining of moderate pain
- 7-8 : Patient complaining of severe pain
- 9-10 : Patient complaining of excruciating pain

Patient sedation score assessed by Ramsay sedation score. The sedation score assessed every 5 min during the surgery till it reached maximum level. In postoperative period, it was assessed every 30 min till the patient was fully awake.

Ramsay Sedation Score[12]

Score – To awake

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE11, 2024

- 1 – Anxious. Agitated
- 2 – Oriented and co operative
- 3 – Responds to verbal commands

Score – To sleep

- 4 – Brisk response to light glabellar tap
- 5 – poor response to light glabellar tap
- 6 – No response

During intra operative and post-operative period all the patients were observed for any side effects like dry mouth, nausea, vomiting, sedation and complications.

Statistical Analysis:

All recorded data were entered using MS Excel software and analyzed using SPSS 22 version software for determining the statistical significance.
Results were expressed as mean, median, mode, standard deviation and proportions.
Since the data doesn't follow normality, the non-parametric tests are applied.
The Mann-Whitney U test was used to determine whether there was a statistical difference between the groups. And Friedman test is applied to find the difference within group.
p-value of < 0.05 was considered to be statistically significant, <0.001 was highly statistically significant.

RESULTS

The mean(SD) age in Group A is 35(SD=15.5) and Group B is 37 (SD= 11.7) years.
18 (40%) were Female and 27 (60%) were Male with sex ratio M:F = 1: 0.7 in group A and 14 (31.1%) were Female and 31 (68.9%) were Male with sex ration M:F = 1:0.5 in group B.
The Mean and Standard deviation of duration of surgery in Group A: 82.3 ± 35.7 with mean rank 37.9, and Group B 107.3 ± 19.7.

Table 1: Comparison of Demographic profile between the groups

Parameter	Group A	Group B	test-statistic	p-value
Gender (Male & Female)	27 : 18	31 : 14	Chi-square=0.776	0.378
Age (Years) Mean ± SD	38.69 ± 15.5	39.04 ± 11.7	t = - 0.123	0.903
Weight (Kg) Mean ± SD	54.4 ± 6.8	73.5 ± 8.4	t = - 11.844	0.000

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE11, 2024

TABLE 2: COMPARISON OF PULSE RATE AND SBP AND DBP AT DIFFERENT INTERVALS BETWEEN GROUPS

Time	Group	Pulse rate mean	P value	SBP Mean	P value	DBP Mean	P value
0 Min	A	81.0	0.231	125.8	0.902	77.8	0.390
	B	78.8		126.3		79.0	
5 Min	A	82.7	0.028	130.2	0.207	79.7	0.484
	B	78.5		128.6		78.6	
10 Min	A	80.3	0.187	125.0	0.675	76.9	0.411
	B	78.2		125.7		78.2	
15 Min	A	79.4	0.238	122.2	0.851	75.4	0.059
	B	77.8		122.4		77.6	
20 Min	A	78.8	0.072	120.4	0.617	72.7	0.004
	B	76.9		120.0		76.3	
25 Min	A	78.4	0.072	118.1	0.870	72.2	0.002
	B	77.1		119.0		76.6	
30 Min	A	79.0	0.092	118.8	0.241	71.0	0.000
	B	77.6		117.9		75.9	

Table3: COMPARISON OF VARIABLES BETWEEN GROUPS BY MANN- WHITNEY U TEST

Variable	Group A Mean(SD)	Group B Mean(SD)	p value
Sensory duration	394.7(61.6)	631.3(47.3)	0.0000
Motor duration	548.7(37.6)	606.4(33.0)	0.0000
Analgesia duration	413.8(61.8)	1054.9(96.6)	0.0000
Sensory onset	8.53(0.89)	7.33(1.35)	0.000
Motor onset	13.22(1.31)	7.33(1.35)	0.000

DISCUSSION

The present study is a comparative study in which measures are taken to minimise and avoid bias by doing simple random sampling in District Hospital, Tumkur for the period of 1-year from july 2018 to 2019. Primary objective was to evaluate onset time of sensory blockade and motor blockade with ropivaciane and dexmedetomedine, or with ropivacine and clonidine.

In the present study 90 patients aged 18 to 60yrs scheduled for upper limb orthopaedic surgeries under supraclavicular brachial plexus block of ASA 1 and 2 were randomly allotted into two groups.

The mean age in group A was 38.69±15.5yrs and mean age in group B was 39.04±11.7yrs. The mean age is same in both the groups. The mean weight in group A was 54.4±6.8 and in

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE11, 2024

group B was 73.5±8.4kgs. since p<0.05 in weight there is statistical difference in weight between the groups. In group A there were 27 male and 18 female patients while in group B there were 31 male and 14 female patients. Since p>0.05 in gender there is no association between male and female between the groups.
In the present clinical study, Group A had 45 patients who received 1mcg/kg of clonidine with 20ml of 0.5% Ropivacaine and group B had 45 patients who received 1mcg/kg of dexmedetomidine with 20ml of 0.5% Ropivacaine by ultrasound guided supraclavicular brachial plexus block. The dosage of clonidine and dexmedetomidine used in our study were similar to few previous studies.[13,14,8]

In the present study, the mean of sensory onset in group A :8.53±0.89 and group B 7.33±1.35, p value 0.000. Since, p<0.05 there is a statistical significance difference in sensory onset between the groups. Dexmedetomidine had early onset compared to clonidine. The use of dexmedetomidine in group B resulted in faster onset of sensory and motor block. The mechanism of faster onset of block is mediated through blockade of the hyperpolarization-activated cation current (1h current), which is important to bring a peripheral nerve back to the resting potential.[15]
The role of clonidine as adjuvant to ropivacaine in faster onset of sensory and motor block is controversial, with most of previous studies showed no effect on onset of block but with the use of dexmedetomidine with local anesthetics have shortened the onset time of sensory and motor block.[16,17]

In the present study, the mean of sensory duration in group A 394.7±61.6 and group B 631.3±47.3, p value 0.000. since p<0.05 there is a statistical significance difference in sensory duration between the groups. The mean of motor duration in group A 548.7±37.6 and group B 606.4±33.0, p value 0.000. since, p<0.05 there is a statistical significance difference in motor duration between the groups. The mean duration analgesia in group A 413.8±61.8 and group B 1054. 9 ±96.6, p value 0.000, since, p<0.05% there is a statistical significance difference in analgesia duration between the groups.
There was significant increase in mean duration of sensory and motor block and duration of analgesia in both group A and group B. This increase in duration was statistically significant with dexmedetomidine in comparision to clonidine. This prolonged duration of sensory and motor blockade when clonidine and dexmedetomidine was used as adjuvants to local anesthetics in peripheral nerve blocks has been reported in earlier studies by Kenan Kaygusuz MD et al[18] and Singelyn FJ et al[19].

Although in some studies addition of clonidine to 0.75% Ropivacaine did not result in any advantage of brachial plexus block when compared with pure 0.75% Ropivacaine.[20]
However, most of the studies reported the advantages both in terms of quality and duration of block.
There was significant decrease in analgesic consumption in the postoperative period with the use of adjuvants, dexmedetomidine and clonidine. The mechanism of analgesia: Centrally mediated analgesia, $\alpha_2\beta$ adrenoceptor-mediated vasoconstrictive effects, attenuation of inflammatory response and direct action on peripheral nerve.[21,22]

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE11, 2024

The prolongation of analgesia after neural blockade with use of α_2 agonists resulted from increase in potassium conductance and blocking the conduction of C and A fibres.[23]
Besides, clonidine also enhances lignocaine-induced inhibition of C-fiber action potential. Lipophilic nature of clonidine allows rapid absorption into cerebrospinal fluid and binding to adrenoceptor of spinal cord causing blockade at primary afferent terminals (both spinal as well as peripheral nerve endings).[24]

Centrally α_2 agonists produce analgesia and sedation by inhibition of substance P release in the nociceptive pathway at the level of dorsal root neuron and by activation of α_2 adrenoceptors in locus ceruleus.[25]

In the present study intraoperative SBP, DBP, HR, SpO2 was monitored every 2mins till 30 mins then every 5 mins till the end of the surgery. In the present study the mean of pulse rate in Group A 79.0±7.9 and Group B 77.6±6.5 and p value 0.092, since p >0.05 there is no statistical significance difference in pulse rate between both groups. The mean of SBP in Group A 118.8± 6.7 and Group B 117.9±9.1 and p value 0.241, since p>0.05 there is no statistical significance difference an SBP between both the groups. The mean of DBP in Group A 71.0±5.7 and Group B 75.9±4.9 and p value 0.000, since p< 0.05 there is a statistical difference in DBP between both the groups.

There was no clinical or statistical change in respiratory rate or arterial saturation (SpO_2) at all measured intervals in both group A and group B. Singh S et al.[26]and Kenan Kaygusuz MD et al.[18]conducted study by clonidine and dexmedetomidine as adjuvants to local anesthetics an dose of 1mcg/kg body weight in which there was no significant difference in the ventilator frequency or oxygen saturation.[15,26]

Also the hemodynamic parameters (heart rate, mean blood pressure) recorded did not show stastistical difference in both the groups. But both clonidine and dexmedetomidine resulted in lower heart rate and blood pressure however, there was no need for pharmacological interventions.

The results of the study showed no adverse effects like hypotension, bradycardia or sedation with both the groups. Most of the studies conducted using clonidine and dexmedetomidine in peripheral nerve block did not report any adverse effects.

CONCLUSION

Therefore, in present study it was found that addition of clonidine and dexmedetomidine to 0.5% ropivacaine are effective in supraclavicular brachial plexus block. However, dexmedetomidine is a better alternative to clonidine to obtain early onset and prolonged duration of sensory and motor block and postoperative analgesia.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE11, 2024

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