

A COMPARATIVE STUDY OF CLONIDINE AND DEXMEDETOMIDINE AS AN ADJUVANT TO 0.5% BUPIVACAINE IN ULTRASOUND GUIDED INFRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB ORTHOPAEDIC SURGERIES

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Abstract

Background: An anaesthesiologist's biggest challenge is controlling pain following procedures on the upper limbs. In recent times, alpha 2 agonists have become increasingly important as an adjuvant to extend the duration of peripheral, extradural, and intrathecal nerve blocks. **Aim:** The main aim of the study is to compare the effects of clonidine and dexmedetomidine as an adjuvant to bupivacaine in ultrasound guided infraclavicular brachial plexus block. **Materials and Methods:** In this prospective, comparative, double-blinded randomized study, 60 patients scheduled for elective upper limb surgeries under ultrasound guided infraclavicular brachial plexus block, under American Society of Anaesthesiologists (ASA) class I and class II were divided into two equal groups as group C & D. Group-C received Inj. clonidine 1 µg/kg and group-D received Inj. dexmedetomidine 1 µg/kg added to bupivacaine 0.5% (20 mL). Onset and recovery time of sensory and motor block were studied in both the groups. Data analysis was done using SPSS and continuous variables and categorical variables were interpreted using frequencies (mean ±SD) and proportions (%). **Results:** The mean time of onset of sensory block for group C and group D were 7.08±0.97 and 3.91±0.78 respectively. The mean time for onset of motor block for group C and group D were 8.55±1.13 and 5.63±0.71 respectively. The mean time of onset of sensory and motor block between two groups was faster in group D than group C and it was statistically significant (p <0.05). The mean duration of sensory block for group C and group D were 375.53±43.54 and 502.8±47.48 respectively. The mean duration of motor block for group C and group D were 308.93±40.37 and 431.9±49.55 respectively. The mean duration of sensory and motor block was prolonged in Group D as compared to Group C which was statistically significant. **Conclusion:** The addition of dexmedetomidine to bupivacaine in brachial plexus block by infraclavicular approach results in a shorter onset time for sensory and motor blockade, prolongs the duration of sensory and motor blockade without any adverse side effects.

INTRODUCTION

Pain is a complex phenomenon which depends on an individual's emotional state and his past experiences of perceiving pain. By the end of the 19th century, it had been widely accepted that acute pain constituted a unique sensory modality that could be interfered with by blocking conduction with local anaesthetics.^[1]The procedures on the

upper limb can be performed under general, regional, or combined anaesthesia. Regional anaesthesia has several advantages nowadays, including the administration of surgical anaesthetic, total muscle relaxation, improved hemodynamic stability, post-operative analgesia, and the management of chronic pain syndromes.^[2]

Upper limb sensory innervations are provided by the brachial plexus. Brachial plexus blockade can be

performed using a variety of methods and procedures includes interscalene, parascalene, supraclavicular, infraclavicular and axillary approaches. William Halsted was the first to do an axillary approach brachial plexus block.^[3]

Recently the use of alpha 2 receptor agonists clonidine and dexmedetomidine gains new attention in regional anaesthesia because of their increased sedation, improved haemodynamic stability and longer duration of postoperative analgesia. Dexmedetomidine is a selective α_2 – adrenoceptor agonist and clonidine, a partial α -adrenoceptor agonist has been reported to prolong the duration of anaesthesia and analgesia during regional blocks. Dexmedetomidine is a significantly more potent sedative and analgesic drug than clonidine because of its high specificity for the α_2 subtype and eight times greater α_2 : α_1 selectivity.^[4,5]

With advanced technology, ultrasound guided infraclavicular nerve block provides the most reliable and quick way to anaesthetize the entire upper extremity. The most reliable and quick way to anaesthetize the entire upper extremity is to use ultrasound in conjunction with an infraclavicular nerve block. Utilizing ultrasonography not only reduces the injury and the overall dose and it also prevents damage to the nerves caused by the blind paraesthesia technique.^[6]

Objectives

Primary Objective To compare the effects of clonidine and dexmedetomidine as an adjuvant to bupivacaine in ultrasound guided infraclavicular brachial plexus block with respect to onset and duration of sensory and motor block.

Secondary Objective To compare the intraoperative hemodynamic parameters- heart rate, systolic blood pressure and diastolic blood pressure between two groups.

MATERIALS AND METHODS

Study design

- A Prospective, comparative, double-blinded randomised study

Study area

- Department of Anesthesia, Trichy SRM medical college, Trichy

Study duration

- Three months

Study population

- Patients posted for upper limb orthopaedic surgeries.

Inclusion Criteria

- Patients belonging to American society of anaesthesiologists grade 1 &2
- Patients with age between 18 -60yrs
- Both sex
- Unilateral upper limb surgeries

Exclusion Criteria

- Participants not willing to give consent

- Patients with American society of anaesthesiologists grade 3&4
- Patients with age >60 yrs
- Patients with severe systemic illness
- Allergy to study medicines
- Pregnant women
- Patients with bilateral upper limb surgeries
- Sampling technique
- Convenient sampling

Sample size: 60

Operational definition

- Sensory block was assessed by pin prick test by using a 3-point scale^[11]
- 0 = normal sensation,
- 1 = loss of sensation of the pin prick (analgesia)
- 2 = loss of sensation of touch (anaesthesia).
- Motor block was assessed by thumb abduction (radial nerve), thumb adduction (ulnar nerve), thumb opposition (median nerve), and flexion of elbow (musculocutaneous nerve) according to the modified Bromage scale:^[11]
- Grade 0: Normal motor function with complete flexion and extension of the elbow, wrist, and finger
- Grade 1: Decreased motor function with ability to move the fingers onl
- Grade 2: Complete motor block with inability to move the fingers
- The sensory and motor blocks were assessed every 3 mins till the onset of the block. After that they were assessed at 5, 10, 15 mins and then every 15 mins till the end of surgery. After the end of surgery patients were assessed every half hour till complete recovery of sensory and motor function.
- Onset of sensory block- Time interval from the time of complete injection of local anaesthetic till no response to pinprick test (grade 2 of pinprick test)
- Onset of motor block- Time interval from the time of complete injection of local anaesthetic and motor paralysis (grade 2 of modified Bromage scale)
- The duration of sensory block- Time interval from complete sensory block till first postoperative pain.
- The duration motor block- Time interval between the complete paralysis and complete recovery of motor function.

Data Collection

Data was collected in Department of Anaesthesia in Trichy SRM Medical College, Trichy. This study was conducted among 60 patients who were posted for orthopaedic upper limb surgeries. They were randomly allocated into two groups (Group C and Group D) consisting of 30 participants each. Group C participants received 20 ml of 0.5% bupivacaine with 1 μ g/ kg of clonidine and Group D participants received 20 ml of 0.5% bupivacaine with 1 μ g/ kg of dexmedetomidine.

During the patient's preoperative evaluation, weight, basal heart rate, and blood pressure were recorded. Under ultrasound guidance, an infraclavicular approach was used to administer brachial plexus blocks to all of the patients. The onset and duration of sensory block, onset and duration of motor block were assessed. The heart rate was recorded at 0, 10, 15, 30, 45 mins and then every 15 mins till the end of surgery. Systolic and diastolic blood pressure were recorded at the 0, 5, 10, 15, 30, 45 mins and then every 15 mins till the end of surgery. Data was entered in Microsoft excel 2019 and analysed using software SPSS (Statistical Package of Social Sciences) version 21. Continuous variables and categorical variables were interpreted using frequencies (mean \pm SD) and proportions (%).

Ethical issues

Participants were informed about the study and informed consent was obtained

This study was presented to Institutional Ethical Committee(IEC) of Trichy SRM Medical college, Trichy and IEC clearance was obtained.

RESULTS

This study was conducted among 60 patients posted orthopaedic upper limb surgeries. Table 1 describes the demographic data of participants. The mean age of participants was 39.1 ± 7.411 years ranging from 18 – 59 years among Group C participants and the mean age were 37.43 ± 7.523 years ranging from 18 – 59 years among Group D participants.

The mean weight of participants was 64.8 ± 5.013 kgs ranging from 54 – 72kgs among Group C participants and the mean weight was 62.33 ± 5.0187 kgs ranging from 54– 76kgs among Group D participants.

The sex ratio of participants was (male: female) 16:14 in Group C and 20:10 in Group D participants.

Table 1: Demographic data of participants

S No	Characteristics	Group C	Group D	P Value
1	Age (years)	39.1 ± 7.411	37.43 ± 7.523	0.38
2	Weight(Kgs)	64.8 ± 5.013	62.33 ± 5.0187	0.06
3	Gender			
	Male	53.3%	66.66%	0.291
	Female	46.7%	33.33%	
4	Site of surgery			
	Humerus	5 (16.6%)	8 (26.6%)	
	Radius & ulna	22 (73.3%)	18 (60%)	
	Wrist and hand	3 (10%)	4 (13.3%)	
5	Duration of Surgery (Minutes)	156 ± 24	158 ± 18	0.716

Table 2 describes block characteristics among participants. The onset of sensorimotor block was faster among Group D participants than Group C participants and the p value was found to be statistically significant. The duration of sensorimotor block was prolonged among Group D participants than Group C participants and the p value was found to be statistically significant.

Table 2: Block Characteristics

S No	Characteristics	Group C	Group D	p value
1	Onset of sensory block(minutes)	7.08 ± 0.97	3.91 ± 0.78	0.001
2	Onset of motor block(minutes)	8.55 ± 1.13	5.63 ± 0.71	0.001
3	Duration of sensory block(minutes)	375.53 ± 43.54	502.8 ± 47.48	0.001
4	Duration of motor block(minutes)	308.93 ± 40.37	431.9 ± 49.55	0.001

Figure 1 shows mean onset of sensory and motor block among groups.

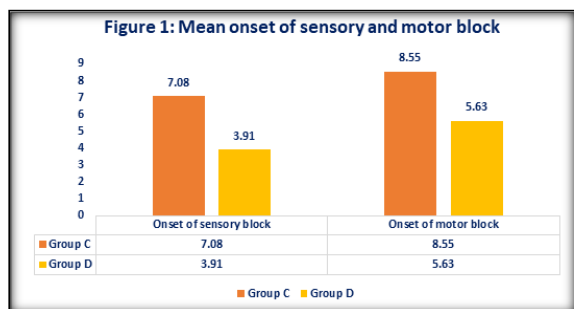


Figure 1: Mean onset of sensory and motor block

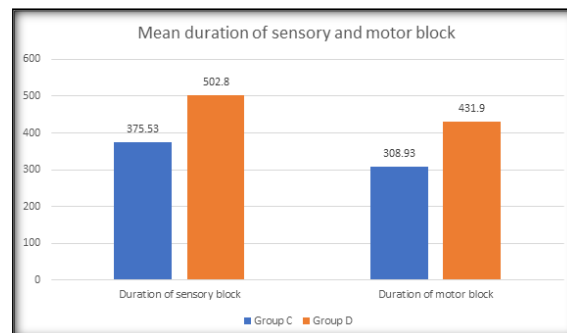


Figure 2: Shows mean duration of sensory and motor block among groups

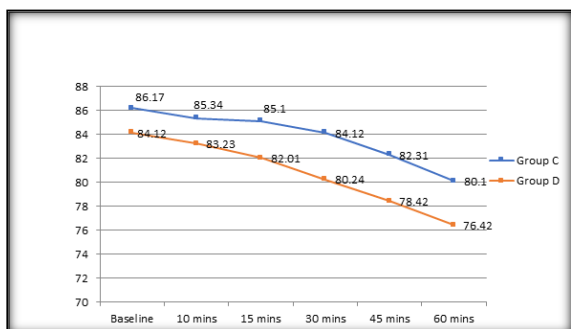


Figure 3: Mean heart rate among study group

Table 3 describes the comparison of heart rate among group participants. The baseline heart rate was statistically insignificant between two groups. The heart rate was significantly higher among Group C compared with Group D at 10, 15, 30, 45, 60 mins.

Table 3: Comparison of HR among participants

Time	Group C (n = 30)	Group D (n = 30)	p-value
0 minutes	86.17±2.32	84.12±6.13	0.092
10 minutes	85.34±3.22	83.23±2.47	0.001
15 minutes	85.10±2.56	82.01±2.47	0.001
30 minutes	84.12±3.82	80.24±2.83	0.001
45 minutes	82.31±5.26	78.42±4.43	0.001
60 minutes	80.16±4.32	76.42±3.62	0.001

Figure 4 shows systolic blood pressure among participants. Systolic Blood pressure was comparable in both groups

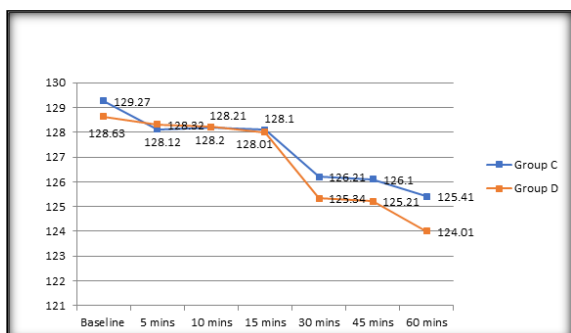


Figure 4: Mean Systolic BP among study group

Table 4 shows the comparison of systolic blood pressure among group participants and it was statistically insignificant at 0, 5, 10, 15, 30, 45, 60 mins.

Table 4: Comparison of HR among participants

Time	Group F (n = 30)	Group L (n = 30)	p-value
0 minutes	129.27±4.103	128.63±6.24	0.355
10 minutes	128.12±3.103	128.32±5.26	0.323
15 minutes	128.20±4.36	128.21±6.32	0.345
30 minutes	128.10±4.45	128.01±5.47	0.432
45 minutes	126.21±2.97	125.34±5.49	0.367
60 minutes	126.10±4.27	125.21±6.11	0.453

Figure 5: Shows diastolic blood pressure among participants. Diastolic Blood pressure was comparable in both groups.

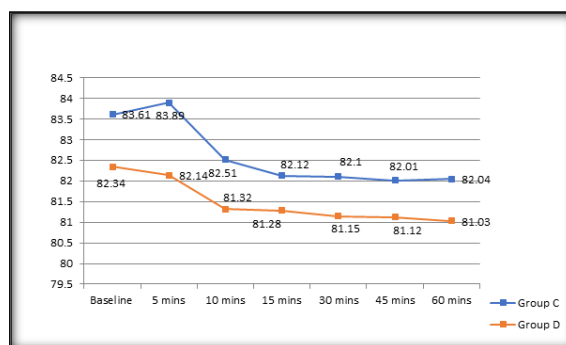


Figure 5: Mean diastolic BP among study group

Table 5 Shows the comparison of diastolic blood pressure among group participants and it was statistically insignificant at 0, 5, 10, 15, 30, 45, 60 mins.

Table 5: Comparison of HR among participants

Time	Group F (n = 30)	Group L (n = 30)	p-value
0 minutes	83.61±4.36	82.34±3.19	0.203
5 minutes	83.89±4.2	82.14±2.66	0.058
10 minutes	82.51±4.97	81.32±1.81	0.089
15 minutes	82.12±4.36	81.28±2.43	0.058
30 minutes	82.10±3.19	81.15±2.98	0.053
45 minutes	82.01±2.19	81.12±2.86	0.067
60 minutes	82.04±2.49	81.03±2.17	0.345

DISCUSSION

In our study we found that the mean age of the study participants in Group C and Group D were 39.1±7.411 years and 37.43±7.523 respectively. In the present study the duration of sensory block (duration of analgesia) was significantly longer in the bupivacaine–dexmedetomidine group 502.8±47.48 mins while in bupivacaine–clonidine group it was 375.53±43.54 showing a mean prolongation of 127.27 mins. A study done by Gandhi et al, Sreeja et al also stated that there is significant prolongation in the duration of analgesia when dexmedetomidine was used as an adjuvant with bupivacaine.^[7,8]

In the present study it was found that the onset of motor block and the sensory block is shortened by 2.92 mins and 3.17 mins respectively. This is comparable to a study conducted by Sreeja et al also found that the onset of motor block is shortened by 4 mins and the onset of sensory block is shortened by 5.47 mins.

A study by Swami et al, Harshavarthana et al.^[9,10] also stated that there onset of motor and sensory block is faster with dexmedetomidine group than clonidine group which is also in consistent with our study report.

In our study it was shown that the mean duration of motor block for group C and Group D participants

as 308.93±40.37 and 431.9±49.55. The duration of motor block was prolonged among Group D participants than Group C participants and the p value was found to be statistically significant.

This is similar to a study conducted by Sreeja et al also found that the mean duration of motor block in Clonidine group was 422.5 ± 9.05 min while in dexmedetomidine it was 664.93 ± 20.4 mins with a significant prolongation of the duration of the motor block in the dexmedetomidine group.

Another study by Agarwal et al.^[11] also compared the effects of adding dexmedetomidine to bupivacaine in supraclavicular brachial plexus block and stated that dexmedetomidine added as an adjuvant shows significant prolongation in the duration of sensory and motor blocks which is also comparable to our study report.

CONCLUSION

In our study we found that the use of dexmedetomidine, as an adjuvant with 0.5% bupivacaine in infraclavicular brachial plexus block, accelerates the onset of the sensory and motor block, prolong its duration, and has no significant adverse effects. It may be used as an adjuvant for nerve blocks due to the benefits of conscious sedation and hemodynamic stability. Hence Dexmedetomidine can be considered as a better adjuvant than clonidine in infraclavicular brachial plexus block during upper limb surgeries.

Limitations

- The larger sample size might be considered for generalising results.

Conflict of interest

- Nil

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