ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

Clonidine and dexmedetomidine as adjuvant to ropivacaine for supraclavicular brachial plexus block during upper limb surgery: A comparative study

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Submission: 05-04-2022 Revision: 29-05-2022 Publication: 01-07-2022

ABSTRACT

Background: Various adjuvants are added to local anesthetics to increase the duration of block during supraclavicular brachial plexus (SCBP) block. Dexmedetomidine, a newer and potent alpha2 receptor agonist, has 10 times higher selectivity than clonidine. Many studies have already evaluated the efficacy of clonidine and dexmedetomidine as perineural adjuvants and have reported wide variations in the prolongation of post-operative analgesia. Some studies have reported the absence of adjuvant's effect while a few have not focused all the facets of block characteristics. **Aims and Objectives:** The aim of the study was to compare the efficacy of clonidine and dexmedetomidine as adjuvant to ropivacaine during SCBP block for the upper limb surgeries, in terms of duration of post-operative analgesia (Primary outcome). The onset and duration of sensory and motor block, and adverse effects, if any, were observed. **Materials and Methods:** Ninety patients, aged between 40 and 60 years of either sex, undergoing upper limb surgery, were randomly allocated in to three groups to receive either 30 ml of 0.5% ropivacaine and 2 ml saline (Group R, n = 30) or 30 ml 0.5% ropivacaine plus clonidine (1 mcg/kg) plus saline to make a total volume 32 ml (Group C, n = 30), or 30 ml 0.5% ropivacaine and dexmedetomidine (1 mcg/kg) plus saline to make a total volume 32 ml (Group D, n = 30). The duration of post-operative analgesia, other block characteristics, and adverse events, if any, was assessed. **Results:** Mean duration of post-operative analgesia was found to be considerably higher in dexmedetomidine group compared with clonidine group and ropivacaine alone group (664.13 vs. 551.77 vs. 465.47, respectively, P < 0.001). The duration of sensory and motor block was considerably longer in dexmedetomidine group compared with clonidine and control group. Adverse events were comparable among the three groups. **Conclusion:** Dexmedetomidine appears to be a better alternative to clonidine as adjuvant in terms of prolonged post-operative analgesia and comparable adverse events.

Key words: Analgesia; Anesthetics; Brachial plexus block; Clonidine; Dexmedetomidine; Local; Peripheral nerves; Ropivacaine, Upper extremity

Access this article online

Website: http://nepjol.info/index.php/AJMS

DOI: 10.3126/ajms.v13i7.44299

E-ISSN: 2091-0576

P-ISSN: 2467-9100

INTRODUCTION

The upper limb surgery is often performed under brachial plexus block to avoid the adverse events of general anesthesia and to have additional benefits such as extended postoperative analgesia, early ambulation, early initiation of oral feed, avoiding airway manipulation, and minimizing post-operative nausea and vomiting.[1] Adjuvants are often added to local anesthetics (LAs) to prolong the duration of analgesia.[2] Clonidine as adjuvant to intermediate-acting or long-acting LAs for peripheral nerve block or plexus block was already found to prolong the duration of postoperative

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analgesia by about 2 h[3] or even 3–4 h.[4] Clonidine has been found to improve the block characteristics of bupivacaine[5,6] or ropivacaine[7,8] for brachial plexus block in terms of hastening the onset and prolonging the duration of sensory and motor block. Clonidine as adjuvant to levobupivacaine has been found to yield "no benefit"[9] while the contrast reporting[3,4] does exist where clonidine's efficacy was found to be maximal [3] when combined with levobupivacaine (more than 4-h prolongation). The use of clonidine (2 mcg/kg) as adjuvant to bupivacaine for supraclavicular brachial plexus (SCBP) block was found to provide faster onset and prolonged analgesia without any considerable hemodynamic adverse events.[6] However, in the context of prolongation of analgesic effect and reduction of opioid rescue dosage, the addition of clonidine (150 mcg) to ropivacaine has been observed to be unhelpful during brachial plexus block[10] and adductor canal block.[11]

Addition of dexmedetomidine has been found to prolong the duration of SCBP block of bupivacaine by 8 h[12] and that of ropivacaine by 4 h.[13] Dexmedetomidine as adjuvant to ropivacaine for ulnar nerve block was found to prolong the analgesia by about 200 min.[14] Hence, it appears that clonidine and dexmedetomidine both as adjuvant to bupivacaine for use in SCBP blocks have been found to prolong sensory as well motor blockade when combined individually. In a single study comparing both the adjuvants, dexmedetomidine was found to yield more pronounced motor blockade than clonidine when added to bupivacaine.[15]

There is a variability in the reported effect of block prolongation due to the use of adjuvants such as clonidine or dexmedetomidine. Some studies[7,8] have reported about prolongation of block due to the use of clonidine as adjuvant while remaining silent about other facets of block characteristics such as the onset of block. There are studies where ropivacaine or clonidine have been studied separately to examine their effect as adjuvant on block characteristics. However, it was found that there is a paucity of studies[16,17] where both the clonidine and dexmedetomidine have been evaluated as adjuvant to LAs for SCBP block in a single study frame. Moreover, those studies have not reported the effect on all components or facets of block characteristics such as onset or duration of sensory or motor block. Evidence is accumulating in this aspect and there is a further scope of such studies. These are the lacunae identified, and hence, the present study has been designed to compare the block characteristics of ropivacaine using either clonidine or dexmedetomidine as perineural adjuvant.

Aims and objectives

To address the afore-mentioned gap in the literature, the present study was designed to compare the efficacy of clonidine and dexmedetomidine, used as an adjuvant to ropivacaine in SCBP block for the upper limb surgeries, in terms of the duration of post-operative analgesia (Primary outcome). The onset times of sensory and motor block and the durations of sensory and motor block, and adverse effects, if any, were also observed.

MATERIALS AND METHODS

After obtaining the approval from the Institute's Ethics Committee (CNMC/15-dated January 8, 2015), this double-blind and randomized study was conducted for a period of approximately 1 year in a tertiary care hospital. After obtaining the written informed consent, 90 patients between the age 40 and 60 years of either sex undergoing upper limb surgeries were recruited in the study. Patients with known allergy to study drugs, having history of substance abuse, addiction to alcohol, receiving chronic analgesic therapy with opioid drugs were excluded from the study. The patients who would require general anesthesia, those who would require surgeries in both hands, and those who had been suffering from considerable neurological, cardiovascular, renal, or coagulation disorders were excluded from the study. During pre-operative evaluation, the patients were selected based on inclusion and exclusion criteria.

Sample size calculation

The sample size was calculated using the following formula (Calculating the sample size by comparing two means):[18] $n=2\ (Z\alpha+Z\beta)^2\times SD^2/d^2$ where n = sample size in each group, $Z\alpha$ (Conventional multiplier for alpha) value is 1.96 when significance level alpha is set at 0.05; the $Z\beta$ (Conventional multiplier for power [1-β]) is 0.84 when power is set at 80%. SD is the standard deviation of the conventional group, d = the effect size = the minimum clinically important difference that the investigator wishes to detect. We assumed that a minimum difference of 60 min in post-operative analgesia (duration of analgesia) would be clinically important to detect. Hence, the value of "d" in the equation was substituted as 60. The sample size calculation was done at two steps. In the context of clonidine's effect over control (no adjuvant), two previous studies were consulted where the values of SD were found to be 51[19] and 95[7] in the ropivacaine alone group while comparing with ropivacaine-clonidine combination. Hence, the average value of 73 was taken as SD for the control group and the sample size per group was calculated to be 23. Again, in the perspective of comparing dexmedetomidine over clonidine (control), the SD was found to be 70 in the control group of another study by Kanvee et al.[17] In this step, with the above assumptions of effect size (d) and study settings (alpha and beta error), the sample size was calculated to be

21 per group. Hence, the higher value between the two, that is, 23 was considered as the required sample. Anticipating the possibility of about 10% non-response rate, the sample size reached approximately 26 which is rounded off to 30 to err on the safe side. Thus, a minimum of 30 patients was considered for each group.

The patients were then randomly allocated into three groups to receive either 30 ml of 0.5% Ropivacaine and 2 ml of normal saline (Group R, n=30) or, 30 ml of 0.5% Ropivacaine and Clonidine (1 μg/kg) + NS is added to make a total volume of 32 ml Group C, n=30) or 30 ml of 0.5% Ropivacaine and Dexmedetomidine (1 μg/kg) + NS is added to make a total volume of 32 ml (Group D, n=30) according to the online random number generated (www.random.org). The record sheets of the patients were coded. At the end of the study, the decoding was done before statistical analysis. The study patients as well as the anesthesiologist who assessed the outcome parameters after administration of anesthesia were blinded regarding the group allocation.

Routine laboratory examinations of all patients recruited in the study were done including complete hemogram, urine analysis and whenever appropriate blood sugar, ECG, and chest skiagram. Intravenous cannula was established in the limb opposite to that undergoing surgery with 18-G cannula. Monitor (having parameters such as ECG monitoring, pulse oximeter, and non-invasive blood pressure) was attached and all the patients were monitored periodically. The baseline blood pressure (MAP), heart rate, and hemoglobin oxygen saturation (SpO_2) were recorded. Patients were stabilized on to supine position with their arms kept by the side of the body and extended along the side and head turned off from the side to be blocked. The SCBP block was executed using subclavian perivascular approach described by Kulenkampff, modified by Winnie and Collins.[20] After obtaining paresthesia and ensuing negative aspiration, 35 mL of a solution containing LAs (Ropivacaine 0.5%) alone or combined with clonidine or dexmedetomidine as mentioned above was injected followed by a 3 min massage for a balanced drug distribution.

The onset and duration of sensory and motor blockade, duration of post-operative analgesia, and adverse events (if any) were observed meticulously and recorded accordingly. The sensory block was assessed by pinprick on skin dermatomes C4 to T2 with 22-G hypodermic needle. Motor block was assessed using 3-point Bromage scale[6] where 0 – normal motor function with full extension and flexion of elbow, wrist, and fingers, 1 – decreased motor strength with ability to move the fingers only, and 2 – complete motor block with inability to move elbow, wrist, and the fingers. The depth of anesthesia was assessed by Ramsay Sedation Score[21] where 1 – anxious and agitated or restless or both, 2 – cooperative, oriented, and tranquil, 3 – responding to commands only, 4 – brisk response to light glabellar tap, 5 – sluggish response to light glabellar tap, and 6 – no response to light glabellar tap, respectively. Evaluation was carried out for every 2 min for the first 10 min after completion of the injection and after that every 15 min intraoperatively till the end of surgery.

The following definitions were used for observation of data. The onset time of sensory blockade was defined as the time progressed between injection of drug and complete loss of pinprick sensation of the hands. The onset time of motor blockade was defined as the time progressed from injection of drug to complete motor block. The duration of sensory blockade was considered as the time from the onset of sensory blockade to onset of pain at the surgical site. The duration of motor block was defined as the time from the onset of motor blockade to the complete recovery of abduction at shoulder joint against gravity. The period of analgesia defined as the time between onset of action and onset of pain was the time when patients received the first dose of analgesic. Additional analgesia was contemplated when visual analog scale score was high.

Those study participants requiring supplementation with intravenous analgesics or general anesthesia due to inadequate/partial block were excluded from the study. Hudson's mask was used in all patients @ 5–6 liters/min throughout the process and in post-anesthesia care unit (PACU) following operation.

Any adverse events such as hypotension (20% decrease in relation to the baseline value), bradycardia (HR<60 bpm), hypoxemia (SpO_2 90%) nausea, vomiting, pneumothorax, Horner's syndrome, or hematoma were recorded carefully in case of their occurrence. Operated patients were shifted to PACU immediately and monitored for next 1 day to assess the total duration of sensory and motor blockade and to evaluate pain using visual analog scale (VAS) score. The peripheral arterial SpO_2, heart rate, and BP were recorded at specific interval of time. The injection diclofenac at a dose of 1 mg/kg through intramuscular route was used as rescue analgesic, when pain assessment using VAS revealed a score >3 or on demand by patients. Inj. ondansetron at a dose of 0.05–0.15 mg/kg i.v. was given for nausea and vomiting.

Statistical analysis

Categorical variables are expressed as number and percentage of patients and have been compared among the groups using Pearson's Chi-square test for independence of attributes. Continuous variables are presented as

Mean±Standard deviation and have been compared across the three groups using one-way ANOVA test and between the two groups using *post hoc* LSD. All data have been analyzed using the statistical software SPSS version 20. P<0.05 has been considered as significant.

RESULTS

The study spanned over 1 year approximately, from January 2015 to March 2016. Data from all 90 patients were available for analysis. The demographic profile such as age, sex, weight, ASA status, and duration of surgery was comparable in both the study groups and their difference was statistically insignificant (P>0.05) (Table 1).

The onset of sensory and motor block was found to be statistically significant in Group C and Group D when compared with Group R. The onset of both sensory and motor block in Group D was found considerably lower when compared head-to-head with Group C (Table 2). The duration of motor block was found to be statistically significant (P<0.001) in Group C and Group D when compared to Group R; and again, that in the Group D was found to be considerably significant when compared head-to-head with Group C (Table 2). Regarding the duration of sensory block and duration of analgesia in Group C and Group D were found to be considerably longer as compared to Group R. The duration of sensory block and duration of analgesia in the Group D appeared to be considerably prolonged when compared with Group C (Table 2).

Analyzing the sedation score (Table 3), it was observed that Group C and Group D had no statistically significant difference when compared to Group R at 1- and 5-min interval. However, at 10 min interval, almost all patients were awake and alert and had sedation score of 1. Only few patients Group C (16.67%) and Group D 26.67% had sedation score of 2 at 10 min which was statistically significant. There was a significant statistical difference in sedation score between Group R versus C and R versus D (P<0.05) at 20- and 30-min interval but at the last point of assessment, that is, 2-h interval, there were no significant differences. The sedation score between Group C and Group D was remained statistically insignificant all throughout time interval.

Analyzing by one-way ANOVA test, there was no significant difference in variation of heart rate (Table 4), mean arterial blood pressure (Table 5), and SpO_2 (Table 6) between the three study groups (P>0.05). Adverse events such as nausea, vomiting, bradycardia, hypotension, and seizure were not found in any study group.

DISCUSSION

Peripheral nerve blocks with LAs provide good operating conditions with adequate muscle relaxation but the period of analgesia is generally not maintained for more than 4–6 h even with the longest acting LAs such as bupivacaine, ropivacaine, and levobupivacaine. For longer pain control, continuous peripheral nerve blocks by infusion of LAs

Table 1: Demographic data

Parameters	Group R (n=30)	Group C (n=30)	Group D (n=30)	P-value
Age (years)	49.17±3.39	50±3.62	49.57±4.29	0.693
Male: Female*	24:6	24:6	18:12	0.129
Height (cm)	160.5±7.15	158.53±6.93	157.8±7.07	0.313
Weight (kg)	56.53±2.66	56.5±2.67	56.97±2.72	0.755
Duration of Surgery	121.83±8.04	127.5±10.81	126.33±12.24	0.094

Data are presented as mean and standard deviation and compared using one-way ANOVA test except the data marked with * which is categorical data and tested with Chi-square statistics. The result is not significant at P<0.05.

Table 2: Block characteristics

Times (in minutes)	Group R (n=30)	Group C (n=30)	Group D (n=30)
Onset of Sensory Block	14.2±2.72	11.77±1.92	10.2±1.69
P values between two groups; R vs. C: <0.001; R vs. D: <0.001; C vs. D: <0.001			
Duration of Sensory Block	369.6±11.91	580.47±19.23	635.53±14.48
P values between two groups; R vs. C: <0.001; R vs. D: <0.001; C vs. D: <0.001			
Onset of Motor Block	18.13±1.74	13.53±1.89	11.47±1.33
P values between two groups; R vs. C: <0.001; R vs. D: <0.001; C vs. D: <0.001			
Duration of Motor Block	337.9±9.36	531.5±13.87	583.8±15.14
P values between two groups; R vs. C: <0.001; R vs. D: <0.001; C vs. D: <0.001			
Duration of Analgesia	465.47±10.71	551.7±19.11	664.13±11.64
P values between two groups; R vs. C: <0.001; R vs. D: <0.001; C vs. D: <0.001			

vs.: versus; Data are presented as Mean±SD.

Table 3: Sedation scores at different time points

Sedation scores	Group R (n=30)	Group C (n=30)	Group D (n=30)
At 1 min	30:0	30:0	30:0
At 5 min	30:0	30:0	30:0
At 10 min	30:0	25:5	22:8
P-values (at 10 min): R vs. C: 0.02; R vs. D: 0.02; C vs. D: 0.347; and Overall: 0.012			
At 20 min	30:0	20:10	15:15
P-values (at 20 min): R vs. C: 0.001; R vs. D: 0.0001; C vs. D: 0.19; and Overall: 0.000			
At 30 min	30:0	18:12	12:18
P-values (at 30 min): R vs. C: 0.0001; R vs. D: 0.0001; C vs. D: 0.121; and Overall: 0.000			
At 120 min	30:0	30:0	30:0

Compared across three groups overall and between two groups using Chi-square test. vs.: versus; Data are presented as number of patients

Table 4: Heart rate at different time points

Heart rate	Group R (n=30)	Group C (n=30)	Group D (n=30)	P-value
0 min	84.30±5.86	75.00±9.00	79.80±5.26	0.28
5 min	81.00±6.49	73.21±7.69	78.00±5.40	0.26
10 min	79.86±5.29	71.83±8.10	76.10±5.18	0.19
20 min	82.16±7.26	70.53±6.95	74.53±6.47	0.30
30 min	78.86±6.13	69.66±7.15	73.00±6.10	0.29
120 min	79.40±5.48	70.23±8.28	72.23±5.95	0.37
240 min	77.06±5.73	69.86±6.84	72.00±4.49	0.14
360 min	78.90±5.25	69.00±7.13	70.96±4.13	0.22
480 min	77.82±6.13	68.23±6.28	69.73±6.28	0.11
540 min	78.33±6.85	68.00±7.00	68.30±3.82	0.32
600 min	76.13±7.00	67.20±8.28	67.96±4.32	0.18

Data are presented as Mean±SD.

Table 5: MAP at different time points

MAP (mm Hg)	Group R (n=30)	Group C (n=30)	Group D (n=30)	P-value
0 min	90.96±10.43	85.60±8.20	87.23±8.12	0.29
5 min	90.30±9.69	83.90±8.12	86.33±7.50	0.37
10 min	91.45±10.72	83.06±7.60	85.00±7.01	0.14
20 min	89.06±10.23	82.46±7.79	84.06±6.95	0.22
30 min	88.90±9.31	82.00±7.32	82.90±7.80	0.11
120 min	87.50±8.40	81.80±6.75	82.13±6.65	0.58
240 min	88.43±9.33	80.85±7.93	80.66±6.98	0.38
360 min	89.10±9.99	78.93±7.09	80.13±7.75	0.41
480 min	89.06±9.69	78.00±7.89	79.96±7.45	0.28
540 min	87.83±9.11	79.13±6.95	78.00±7.65	0.26
600 min	88.08±8.98	78.20±8.23	76.85±6.89	0.19

Data are presented as Mean±SD, MAP: Mean arterial pressure

into brachial plexus sheath using an infusion pump can provide site-specific anesthesia and curtail the use of opioids. However, it has some disadvantages such as the difficulty of catheter insertion, chance of dislodgement, the possibility for accumulative toxicity, uncertain fluctuation in absorption, and high cost. Hence, there is a ceaseless quest for a method which can furnish longer period of analgesia without inconvenience to the patient and without considerable adverse events. A single-shot peripheral

Table 6: Peripheral arterial oxygenation (SpO_2) at different time points

SpO_2%	Group R (n=30)	Group C (n=30)	Group D (n=30)	P-value
0 min	99.00±0.00	99.00±0.00	99.00±0.00	0.43
5 min	99.00±0.00	99.00±0.00	98.73±1.10	0.31
10 min	99.00±0.00	98.23±1.10	98.86±1.23	0.58
20 min	98.50±1.02	98.46±0.18	98.53±1.13	0.56
30 min	98.78±1.21	98.63±0.38	98.46±1.03	0.35
120 min	99.00±0.00	98.89±0.78	98.36±1.07	0.56
240 min	99.00±0.00	99.00±0.00	98.70±1.22	0.45
360 min	98.75±1.16	98.73±1.18	98.20±0.90	0.60
480 min	98.20±1.22	98.20±1.11	99.00±0.00	0.58
540 min	99.00±0.00	99.00±0.00	98.12±1.13	0.38
600 min	99.00±0.00	98.18±1.07	99.00±0.00	0.41

Data are presented as Mean±SD

nerve block with adjuvant drugs to extend the duration of action might be the solution for such and is being used commonly.[22]

Many research work has reported the advantages of several adjuvants such as neostigmine, opioids, dexamethasone, hyaluronidase, midazolam, and α2 agonists (clonidine and dexmedetomidine).[22] Clonidine as an adjuvant to ropivacaine hastened the onset of sensory and motor block and improved the duration of sensory and motor block without producing any adverse events during SCBP block when used at 1 μg/kg[19] or at a fixed dose of 75μg.[23] Dexmedetomidine as adjuvant hastened the onset of bupivacaine-induced sensory and motor block and increased the duration of sensory and motor blocks without considerable adverse effects such as hypotension and bradycardia.[24,25]

The present study revealed that the dexmedetomidine as adjuvant has yielded benefits in terms of faster onset of sensory and motor block compared to clonidine or no adjuvant. The use of either dexmedetomidine or clonidine has extended the period of sensory and motor block to a considerable extent. Dexmedetomidine as an adjuvant to ropivacaine decreases the onset of motor and sensory block and increases the duration of sensory and motor block in SCBP block.[26] Similar results were also observed with dexmedetomidine as perineural adjuvant to ropivacaine during interscalene[27,28] and ultrasound-guided SCBP[29] block.

In the present study, none of the patients of either study groups required intra-operative supplementation with other agents to augment analgesia or conversion to general anesthesia for completion of surgery. A considerable prolongation of analgesia was observed with dexmedetomidine as compared to clonidine. Dexmedetomidine as an adjuvant yielded earlier sensory block and more prolonged post-operative analgesia as

compared to clonidine when added to ropivacaine.[30] A glimpse of outcome with different studies is depicted in Table 7 for a comprehensive view on the effects of clonidine or dexmedetomidine as perineural adjuvants on brachial plexus block.

In the present study, intra-operative sedation scores were considerably higher in first 10–30 min in patients receiving either clonidine or dexmedetomidine when compared with the control group. The higher sedation score in clonidine and dexmedetomidine group did not require any airway instrumentation. This mild sedative effect of clonidine and dexmedetomidine might have produced beneficial effect by relieving the surgery-related anxiety and provided comfort to the patient.

Both dexmedetomidine and clonidine while used in their standard doses did not produce any hemodynamic disbalance and respiratory depression. Even though some patients had minimal fall in systolic and diastolic as well as the mean arterial pressure, all of them maintained their hemodynamic parameters within the normal range. The reason behind this could be an effective analgesia and minimal sedation provided by clonidine and dexmedetomidine in the study groups. Significant variations such as bradycardia, hypotension, and sedation were not encountered in this study which attributes to the possibility of minimal chances of the drug attaining its peak plasma concentration due to the relatively poor vascularity present at the site of injection and its low plasma concentration.

In a meta-analysis[32] of 34 RCTs, the efficacy of dexmedetomidine as adjuvant to LAs during brachial plexus block was analyzed and was found to prolong the mean duration of analgesia by 4.5 h, sensory block by 4 h, and motor block by 3 h, approximately. Moreover, the use of perineural dexmedetomidine was related with a faster onset of sensory block by 9 min and faster onset of motor block by 8 min. Perineural dexmedetomidine increased the odds of adverse effects such as bradycardia, hypotension, and sedation.[32] Another meta-analysis[33] has

Table 7: Review of some studies using perineural adjuvants for brachial plexus block

Studies	Population	Adjuvants, dose	Outcome (Test vs. Control, in minutes)
Authors, year	Approach of plexus block	Group information	Duration of Motor block, Duration of Sensory block, Duration of Analgesia (mean duration is Increased by)
Solanki et al.[23] (2021)	60 adults, SCBP block	Clonidine 75 mcg with Ropivacaine vs. Ropivacaine alone	Duration of Motor block: 600±68 vs. 420±65 (increased by 180 min) Duration of Sensory block: 660±60 vs. 480±60 (increased by 180 min)
Sane et al.[25] (2021)	60 patients, SCBP block	Dexmedetomidine (0.75 µg/kg) with bupivacaine	Duration of Motor block: 488±157 vs. 317±11 (increased by 160 min) Duration of Sensory block: 475±138 vs. 333±94 (increased by 140 min) Duration of Analgesia: 458±205 vs. 308±109 (increased by 150 min)
Kumari et al.[30] (2020)	80 adults, SCBP block	Ropidexmed (1 µg/kg) vs. Ropicloni (1 µg/kg)	Duration of Analgesia: 1262±90 vs. 855±42 (increased by 400 min)
Lin et al.[28] (2018)	114 adults, SCBP block	Ropivacaine in combination with dexmedetomidine versus ropivacaine alone	Duration of Motor block: 430±35 vs. 350±32 (increased by 80 min) Duration of Sensory block: 482±39 vs. 380±37 (increased by 102 min) Duration of Analgesia: 590±41 vs. 532±37 (increased by 58 min)
Dharmarao and Holyachi[31] (2018)	80 adults, SCBP block	Ropivacaine - dexmedetomidine (1 µg/kg) vs. Ropivacaine-Fentanyl (1 µg/kg)	Duration of Motor block: 650±43 vs. 457±33 (increased by 193 min) Duration of Sensory block: 802±46 vs. 590±40 (increased by 212 min)
Rashmi and Komala[27] (2017)	60 patients, Interscalene	Ropivacaine - dexmedetomidine vs. Ropivacaine	Duration of Motor block: 610±13 vs. 456±14 (increased by 154 min) Duration of Sensory block: 717±10 vs. 525±12 (increased by 192 min) Duration of Analgesia: 872±11 vs. 590±15 (increased by 282 min)
Das et al.[26] (2016)	80 adults, SCBP block	Ropivacaine+dexmedetomidine (1 mcg/kg) vs. Ropivacaine alone	Duration of Motor block: 312±50 vs. 185±37 (increased by 127 min) Duration of Sensory block: 379±55 vs. 212±48 (increased by 167 min) Duration of Analgesia: 414±90 vs. 197±29 (increased by 217 min)
Bafna et al.[8] (2015)	80 adults, SCBP block	Ropivacaine-clonidine (2 µg/kg) vs. Ropivacaine 0.5% alone	Duration of Motor block: 881±128 vs. 429±61 (increased by 452 min) Duration of Analgesia: 1017±170 vs. 489±65 (increased by 528 min)
Kathuria et al.[29] (2015)	60 adults, SCBP block	Ropivacaine plus Dexmedetomidine 50 mcg vs. Ropivacaine alone	Duration of Motor block: 755±181 vs. 388±129 (increased by 367 min) Duration of Sensory block: 789±188 vs. 452±113 (increased by 337 min) Duration of Analgesia: 968±311 vs. 537±251 (increased by 431 min)
Patil and Singh[19] (2015)	60 adults, SCBP block	Ropivacaine+Clonidine (1 mcg/kg) vs. Ropivacaine alone	Duration of Motor block: 622±47 vs. 501±45 (increased by 161 min) Duration of Sensory block: 704±43 vs. 556±38 (increased by 148 min) Duration of Analgesia: 878±90 vs. 613±52 (increased by 265 min)
Present study	90 adults, SCBP block	Ropivacaine vs. Ropivacaine+dexmedetomidine (1 µg/kg) vs. Ropivacaine+Clonidine (1 µg/kg)	Duration of Motor block: 584±15 vs. 531±14 vs. 338±9 (increased by 240 min in Dexmedetomidine, and 190 min in Clonidine group) Duration of Sensory block: 635±14 vs. 580±19 vs. 370±12 (increased by 265 min in Dexmedetomidine, and 210 min in Clonidine group) Duration of Analgesia: 664±12 vs. 552±19 vs. 465±11 (increased by 199 min in Dexmedetomidine, and 87 min in Clonidine group)

Population (n), Time to First Analgesia or Duration of Analgesia; Ropi, Ropivacaine; Cloni, Clonidine; SCBP block: Supraclavicular brachial plexus block, vs.: versus

indicated that the use of perineural dexmedetomidine can be superior to clonidine in terms of block characteristics, but inferior to dexamethasone. Compared with clonidine, perineural dexmedetomidine was found to increase the mean duration of analgesia by approximately 3.5 h, sensory block by 3 h, and motor block by 2.75 h.[33] However, that hastening of sensory and motor block onset was not clinically significant.[33] In another meta-analysis[34] of 18 trials (1014 patients), where 515 patients receiving perineural dexmedetomidine. Better analgesia was observed with the use of dexmedetomidine as adjuvant to LAs in brachial plexus block. However, it also increased the risk of bradycardia, hypotension, and somnolence.[34] Such findings might be due to that the dexmedetomidine can have more pronounced inhibitory effect on neuronal action potentials compared with clonidine.

The desired effect of adjuvant for perineural injection is to increase the duration of analgesia without prolonging motor block. Perineural clonidine and dexmedetomidine can increase the duration of analgesia by a mean period of approximately 2 and 4.5 h, respectively. Perineural injection of clonidine and dexmedetomidine can have adverse effects such as bradycardia, hypotension, and sedation.[35] The onset of sensory and motor block was found to be considerably hastened with perineural administration than intravenous administration. The duration of sensory and motor block was also considerably prolonged with perineural dexmedetomidine than intravenous dexmedetomidine. Probably, the local action due to the presence of α2-adrenergic receptors in brachial plexus may contribute to faster onset and longer duration of LA block.[29]

Limitations of the study

The study was conducted with a small sample size, in a single center, and on selected operative indications. The serum concentration of the study drugs was not estimated; thus, their exact pharmacokinetic profile was not assessed. A well-designed study addressing these shortfalls might reveal more facts to consolidate the evidence in a better way.

CONCLUSION

Both clonidine and dexmedetomidine as an adjuvant prolonged the duration of analgesia considerably more than ropivacaine alone. Dexmedetomidine yields more prolongation of post-operative analgesia compared with clonidine as adjuvant. Dexmedetomidine also gives benefit in terms of speedy onset of sensory and motor block compared with clonidine. Both clonidine and dexmedetomidine were found to be comparable regarding generation of intra-operative sedation and untoward effects. Dexmedetomidine can be a better alternative to clonidine as adjuvant to ropivacaine for SCBP block.

ACKNOWLEDGMENT

We pay our homage to Late Prof. (Dr.) Debdas Saha, who was the principal guide for this research work while he was in the Department of Anaesthesiology, Calcutta National Medical College, Kolkata. No word is sufficient to express our gratitude to him for his constant inspiration and regular follow-up for the completion of this clinical work.

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Source of Support: Nil, **Conflicts of Interest:** None declared.