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A PROSPECTIVE, RANDOMIZED, DOUBLE BLINDED, CONTROLLED STUDY TO EVALUATE THE EFFICACY OF DEXMEDETOMIDINE 50µg AND DEXAMETHASONE 8mg AS AN ADJUVANT TO ROPIVACAINE 0.5% FOR SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN ELECTIVE UPPER LIMB SURGERIES.

Anaesthesiology

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ABSTRACT

BACKGROUND: Brachial Plexus Blocks are the popular choice of anaesthesia technique as a part of day care surgeries for upper limb. In this study, efficacy of non opioid adjuvants Dexamethasone and Dexmedetomidine has been evaluated.

MATERIALS AND METHODS: 90 ASA class I and II patients undergoing elective upper limb surgeries were randomly divided into three groups of 30 each. Group C received 0.5% Ropivacaine 28ml with 2ml normal saline, Group DX received 0.5% Ropivacaine 28ml with 8mg Dexamethasone and Group DM received 0.5% Ropivacaine 28ml with Dexmedetomidine 50µg. The primary objective was to know the sensory and motor block onset, total sensory and motor block duration, total duration of analgesia. Secondary parameters were mean arterial pressure, peripheral saturation and sedation score. Statistical methods were carried out through SPSS for Windows(version 16.0)

RESULTS: The sensory and motor block onset was earlier in Group DM compared to Group C and Group DX, while it was later in Group DX compared to Group C. The mean TSBD, TMBD and TDA was longer in Group DX(746.66min, 677.83min, 800.16min) compared to Group C (361.33min, 303.66min, 411.16min)and Group DM(686.33min, 593.5 min, 701.83min). There was no significant change in MAP, SpO2 and sedation scores.

KEYWORDS

Dexamethasone, Dexmedetomidine, Ropivacaine, Brachial plexus block

INTRODUCTION :

Regional anaesthesia in the form of supraclavicular brachial plexus block for forearm surgeries as a primary anaesthetic procedure is being preferred over general anaesthesia. It is not only easy and safe to perform but also avoids undesirable effects of general anaesthesia and decreases opioid consumption as well. Ropivacaine has been used frequently in regional anaesthesia because of its superior cardiac safety profile. But the limitation being analgesia of 4-8 hours, and hence the need of adjuvants. Non opioid additives to local anaesthetics is being preferred as a part of Opioid Free Anaesthesia as it avoids delayed respiratory depression and also avoids other adverse effects like nausea, vomiting, pruritus, urinary retention, postoperative ileus.[1] The commonly used non opioid additives include Clonidine, Dexmedetomidine, Dexamethasone, Magnesium, Sodium bicarbonate etc

Dexmedetomidine is the S-enantiomer of medetomidine, belonging to the imidazole subclass of α2-receptor agonists, similar to Clonidine.[2] By virtue of its effect on α 2 receptors, Dexmedetomidine mediates its analgesic effects. It has been found to prolong analgesia as an adjuvant to local anaesthetics for subarachnoid block, epidural, caudal epidural and peripheral nerve blocks[3].

Dexamethasone is a fluorinated derivative of prednisolone and an isomer of Betamethasone. It is a potent anti inflammatory, anti emetic steroid and also an adjuvant to local anaesthetic. It has been proved to be a safe adjuvant perineurally[4].

This study aims at comparing the efficacy of these two non opioid adjuvants to Ropivacaine for supraclavicular brachial plexus block for upper limb surgeries.

AIM OF THE STUDY:

This study analyzes the efficacy of Dexmedetomidine and Dexamethasone as adjuvants to Ropivacaine in Supraclavicular brachial plexus block in elective upper limb surgeries.

MATERIALS AND METHODS:

After ethical committee clearance, written informed consent was obtained prior surgery from 90 consenting adults patients with physical status American Society of Anaesthesiologists (ASA) classes I and I, aged 18 to 60 years, scheduled for elective upper limb surgeries at K.R.Hospital attached to Mysore Medical College and Research Institute, Mysore from December 2015 to July 2017.

The exclusion criteria included patient refusal, patients allergic to the study drugs, pregnant patients, patients with co morbidities like asthma, cardiovascular diseases, hypertension, obesity, coagulation disorders, psychiatric illnesses and pre existing neurological conditions or neuropathies.

The study group was randomly divided into three groups of thirty each, by closed sealed opaque envelope method.

Group C received - 28ml 0.5% Ropivacaine + 2ml normal saline
Group DX received - 28ml 0.5% Ropivacaine + 8mg Dexamethasone (2ml)
Group DM received- 28ml 0.5% Ropivacaine + 50µg Dexmedetomidine (2ml)

Data was collected in pretested proforma meeting objectives of study. After thorough preoperative assessment, patients were premedicated with tablet Ranitidine 150mg and tablet Alprazolam 0.5mg on the night before the surgery. Intravenous line was obtained with 18G cannula in the unaffected upper limb and co loaded with Ringer lactate 15ml/kg bodyweight. Patients were connected to multi channel monitor for monitoring pulse, blood pressure, respiratory rate, saturation and electrocardiogram and premedicated with i.v Midazolam 0.02mg/kg. All patients were given supraclavicular brachial plexus block using Winnie's perivascular, subclavian approach5 using nerve stimulator and 30ml of study drug was injected at the incremental doses of 3ml with negative aspiration for blood. Intercostobrachial nerve blockade was done separately using 5ml of 1% Lidocaine with Adrenaline. The demographic data (age, sex, weight, height and BMI) and the following parameters were noted:

- Onset of sensory block in each of the dermatomes C5, C6, C7,C8 and T1 separately.
- Onset of motor blockade at the level of shoulder, elbow and wrist.
- Total sensory block duration(TSBD)
- Total motor block duration(TMBD)
- Total duration of analgesia(TDA)
- Heart rate, mean arterial pressure, SpO2.
- Sedation assessed by a Modified Ramsay Sedation Score.

STATISTICAL DATA ANALYSIS

Sample size was calculated using the previous study wherein α value of 0.005 and β value of 0.1, minimum number of patients per group will be 25. Assuming a 20% dropout, 30 patients per group was selected. All the statistical methods were carried out through the SPSS for Windows (version 16.0).

Age, height, weight, BMI, sensory and motor block onset time, TSBD, TMBD and TDA were analyzed by using independent students' t – test. Sex ratio and sedation score were compared using repeated

ANOVA test. Mean arterial pressures, Heart rate and peripheral oxygen saturation was compared using one way ANOVA test.

RESULTS

The study showed no statistical difference in the demographic data like age, sex, height, weight and Body Mass Index (BMI) of the patients among the three study groups.

The mean sensory blockade onset time in C6, C8 and T1 dermatomes of Group DX was later compared to Group C. While it was shorter for Group DM compared to Group C. ($p < 0.001$). Though the results were similar in C5 and C7 dermatomes, it was not statistically significant.

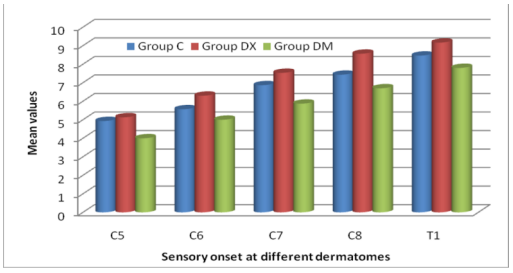

Figure 1 : Sensory onset time at different dermatomes among the groups

The mean motor block onset time at the level of shoulder, elbow and wrist is shown in figure 2.

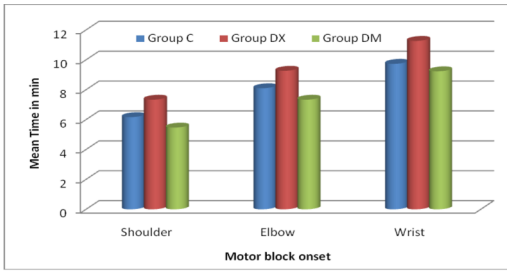

Figure 2: Motor Onset Times At The Level Of Joints Among The Groups

The mean total sensory block duration(TSBD), mean total motor block duration (TMBD) and the mean Total duration of analgesia (TDA) is shown in Figure3

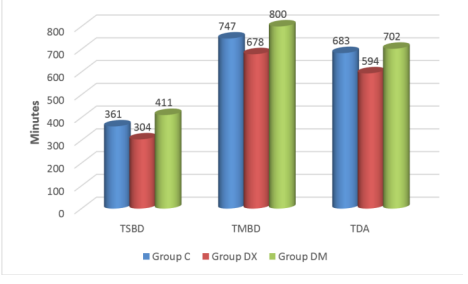

Figure 3 : Mean Total Sensory And Motor Blck Duration And Total Duration Of Analgesia Among The Groups

The mean Mean arterial pressures(MAP) of the three groups is shown in figure 4

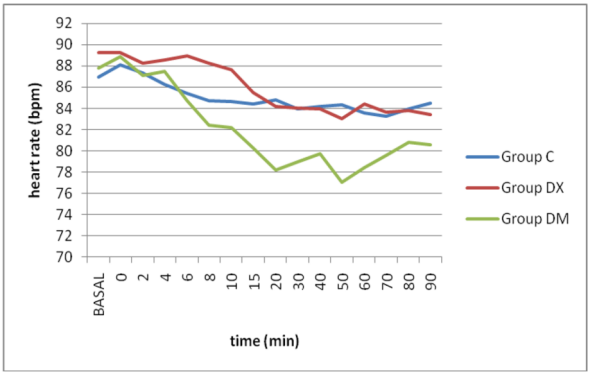

Figure 4: Mean Map Of The Three Groups

The mean heart rate(HR) is shown in figure 5

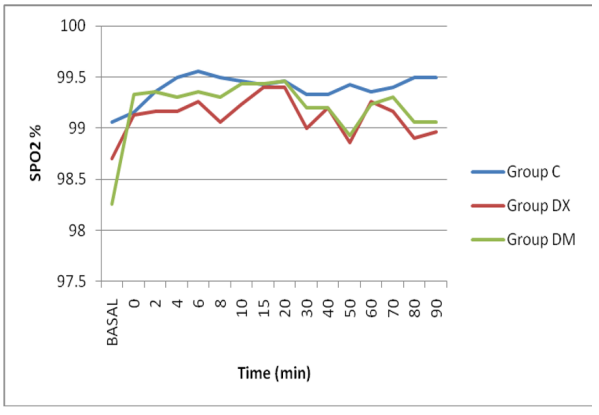

Figure 5 : Mean Heart Rate Among The Groups

The difference in means of peripheral oxygen saturation values among the three groups is shown in figure 6

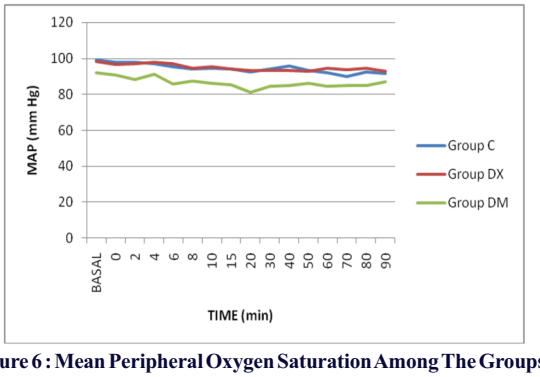

Figure 6 : Mean Peripheral Oxygen Saturation Among The Groups

Sedation was assessed based on Ramsay Sedation Score and the results of our study is in the following table 1.

Table1 : Sedation Scores Based On Ramsay Sedation Score Among The Groups

	Group C No of patients (percentage)			Group DX No of patients (percentage)			Group DM No of patients (percentage)			P value
	1	2	3	1	2	3	1	2	3	
Basal	17 (56.7%)	13 (43.3%)	0 (0%)	17 (56.7%)	13 (43.3%)	0 (0%)	15 (50%)	15 (50%)	0 (0%)	0.836
15 min	2 (6.7%)	28 (93.3%)	0 (0%)	2 (6.7%)	28 (93.3%)	0 (0%)	0 (0%)	21 (70%)	9 (30%)	0.000
30 min	1 (3.3%)	29 (96.7%)	0 (0%)	1 (3.3%)	29 (96.7%)	0 (0%)	0 (0%)	7 (23.3%)	23 (76.7%)	.000
60 min	0 (0%)	30 (100%)	0 (0%)	0 (0%)	30 (100%)	0 (0%)	0 (0%)	7 (23.3%)	23 (76.7%)	0.000
90 min	0 (0%)	30 (100%)	0 (0%)	0 (0%)	30 (100%)	0 (0%)	0 (0%)	20 (66.7%)	10 (33.3%)	0.000
Post op 6th hour	0 (0%)	30 (100%)	0 (0%)	0 (0%)	30 (100%)	0 (0%)	0 (0%)	30 (100%)	0 (0%)	1.00

DISCUSSION:

Brachial plexus block is a popular alternative to general anaesthesia as it is safe, easy , provides good intra operative and post operative analgesia, avoids polypharmacy, early mobilisation , less post operative nausea and vomiting, decreased opioid need and shorter hospital stay. Ropivacaine not only has a longer action but most importantly provides superior cardiac safety profile compared to Bupivacaine. Adding non opioid adjuvants to it can significantly or completely avoid opioid usage. Hence preferred for Opioid Free Anaesthesia in Day care surgeries[1].

The unique properties of Dexmedetomidine, including anxiolytic and opioid sparing properties and minimal respiratory depression, makes it a very attractive drug in the fields of intensive care and anaesthesia.[6] Hyperpolarisation-activated cation currents bring neurons back to the resting potential during the refractory phase in an action potential. By blocking these currents, Dexmedetomidine can accentuate inhibition of neuronal conduction and produce analgesia.[7]

Dexamethasone is believed to improve the quality and duration of peripheral nerve block and the precise mechanism of which is not completely understood. Although glucocorticoids have been reported to have a direct effect on nerves, other studies found Dexamethasone induced peripheral vasoconstriction with concomitant slower absorption of local anaesthetics.8 The anti inflammatory properties of Dexamethasone are probably responsible for prolonged analgesia.

In our study we have chosen 0.5% Ropivacaine for supraclavicular block. The rationale for choosing this was based on the study conducted by Klein et al in 1998, wherein they compared Bupivacaine 0.5%, Ropivacaine 0.5% and Ropivacaine 0.75%. Ropivacaine caused greater sensory and motor differential block than Bupivacaine, which was dose dependent. Higher the concentration, greater was the degree of motor blockade[9]. Hickey and coworkers found that 0.25% Ropivacaine for brachial plexus block required frequent analgesia supplementation[10]

In 2017,Vorobeichik L et al conducted meta analysis study to re-evaluate the basis of perineural Dexmedetomidine and concluded it was safe11. There is some evidence that perineural Dexmedetomidine may be neuroprotective against local anaesthetic induced inflammatory response in some animals[11] decreasing potential nerve injury[12]. Zhang Y et al in their study evaluated different doses of Dexmedetomidine(50µg and 100µg) as adjuvant to Ropivacaine in Brachial plexus block. They found that higher dose of Dexmedetomidine caused bradycardia, hypertension, hypotension and hence we chose Dexmedetomidine 50µg for our study[13]

Cummings K C et al have conducted a study on efficacy of Dexamethasone on Ropivacaine and Bupivacaine. They have used 8mg Dexamethasone in their study and found that it significantly prolonged the duration of analgesia with Ropivacaine more than with Bupivacaine. Hence we have used 8mg dose of Dexamethasone in our study[1].

There was no much statistical difference in the demographic data of the patients like age, sex, weight, height and BMI among the three groups The time for sensory onset was faster with Group DM compared to the other groups, while it was slower in Group DX group compared to other groups. This difference was statistically significant in C6, C8, T1 dermatomes ($P < 0.001$). Our study is not comparable with other studies, as they have not taken sensory onset at dermatomal levels. In our study, the mean motor onset time at shoulder, elbow and wrist level was earlier in Group DM when compared to Group C and Group DX($P < 0.001$). Our study results cannot be compared to other studies quoted, as they have not taken motor onset time on the joint basis.

The mean total sensory and motor block duration was prolonged in Group DX and Group DM compared to Group C, which was similar to various studies [4,7,12,13,14,15,16](17,18). The mean TSBD and TMBD was more in Group DX compared to Group DM ($P < 0.001$). Lee M J et al[19] in their study did not find any statistical difference between Dexamethasone and Dexmedetomidine in their mean TSBD. The difference in the approach, technique and dosages of the drugs could be attributed to the difference in results of our study and theirs.

In our study the mean TDA was longer in Group DX and Group DM compared to Group C which was similar to few studies [4,7,12,13,14,15,16](8,17,18). The Group DX showed longer TDA compared to Group DM similar to Albrecht E et al[20]

The mean HR values of Group DM was less compared to Group C and Group DX, while mean HR of Group C and Group DX were comparable. The difference in mean values of HR among three groups was not statistically significant except only at 50 min, but needing no intervention, similar to few studies[7,15,16]. In the study conducted by Zhang Y et al[9], they found bradycardia in all patients receiving 100µg Dexmedetomidine, but only 9 required intervention with inj Atropine and only 8 patients had bradycardia who received 50µg Dexmedetomidine but only 4 of them needed intervention.

In our study, we found that the difference in means of oxygen saturation among the three groups was statistically not significant at any point of time.

In our study sedation was evaluated using Ramsay sedation score of the patients where there was no difference in scores between Group C and Group DX. In Group DM, there were higher sedation scores at all times compared to Group C and Group DX($P < 0.001$) But there was no excessive sedation in any group requiring any sort of intervention.

CONCLUSION

To conclude, the addition of 50µg of Dexmedetomidine for 0.5% Ropivacaine for supraclavicular brachial plexus block, hastens the onset of sensory and motor block when compared to Dexamethasone 8mg . Nevertheless perineural Dexamethasone resulted in prolonged and superior analgesia compared to perineural Dexmedetomidine. The perineural Dexmedetomidine causes optimum intra operative sedation without any respiratory depression. To conclude, both Dexamethasone and Dexmedetomidine are good non opioid adjuvants with a good safety profile

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