e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(4); 1608-1612

Original Research Article

A Clinical Comparative Study between Ultrasound Guided Supraclavicular Brachial Plexus Block using Ropivacaine Alone or Combined with Dexmedetomidine in Upper Limb Surgeries for Postoperative Analgesia

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Received: 25-01-2024 / Revised: 23-02-2024 / Accepted: 26-03-2024
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Conflict of interest: Nil

Abstract:

Introduction: Brachial Plexus block is a safe alternative to general anesthesia for upper limb surgery, used for reducing pre-operative pain. Techniques include classical blind techniques, nerve stimulators, ultrasound guidance, and supraclavicular block. Ultrasound guidance improves success rates and reduces complications. Additives like oploids, clonidine, dex-amethasone, and hyaluronidase increase block duration and post-operative pain management. Dexmedetomidine, an α2 adrenoreceptor agonist, has been used as an adjuvant to local anesthetics to prolong analgesia and improve block quality.

Methodology: A study at C. U. Shah Medical College and Hospital involved 60 patients aged 20-60 with ASA grade I and II physical status, scheduled for upper limb surgeries.

Discussion: The study compared the duration of analgesia in two groups after surgery. The combination group had shorter onset times for sensory and motor nerve blockade, longer durations, and lower VAS scores. The combination group had lower rates of adverse reactions. The study found no significant differences in age, sex distribution, body weight, ASA status, or surgery duration. Dexmedetomidine was found to be safe for use in small doses with local anesthetics.

Conclusion: Ultrasound guidance improves success rate, reduces complications, and expedites sensory and motor block onset compared to Ropivacaine alone. Addition of Dexme-detomidine prolongs block duration and analgesia duration.

Keywords: Supraclavicular Brachial Plexus Block, infraclavicular block, Ropivacaine, Dexmedetomidine.

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Introduction

Brachial Plexus block has evolved to be a safe alternative to general anaesthesia for upper limb surgery and for relilef of peri-operative pain. Various techniques of brachial plexus block from classical blind technique to use of nerve stimulators and ultrasound guidance, along with various approaches including supraclavicular block, infraclavicular block, interscalene block are nowadays used for upper limb surgeries.

Use of Ultrasound guidance improves the success rate of Supraclavicular block along with reduction in complication. Many additives to local anesthetic such as oploids, clonidine, dexamethasone, hyaluronidase etc. have been used to increase duration of the block and to improve post-operative pain management. Dexmedetomidine, a newer α2 adrenoreceptor agonist is currently focused for its sedative anxiolytic and analgesic properties. The duration of analgesia, when only local anaesthetic is used is very short and does not extend into post-operative period for more than 3-4 hrs. Various drugs have been tried as adjuvant to local anaesthetics for prolonging the analgesia and improving the quality of block. Dexmedetomidine

has been introduced in India and the effectiveness of the same for supraclavicular brachial plexus block has not been vastly investigated in India, as very few studies have been done regarding the same. Hence, we selected dexmedetomidine as an adjuvant to ropivacaine in our study. The current study was designed with aim to evaluate the effect of adding dexmedetomidine to Ropivacaine (0.5%) in supraclavicular brachial plexus block in terms of onset and duration of sensory and motor block, and duration of post-operative analgesia.

Aims and Objectives

Aim:

To compare and evaluate effect of Dexmedetomidine as an adjuvant to ropivacaine alone in supraclavicular Brachial Plexus block for upper limb surgery

Objectives:

1. Compare total duration of analgesia in both groups.
2. Compare onset and duration of sensory block in both groups.
3. Compare onset and duration of motor block in both groups

Methodology

A observational study was conducted at C. U. Shah medical College and Hospital after approval from hospital Scientific Committee. 60 patients with physical status ASA grade I and II aged between 20 - 60 years, scheduled for upper limb surgeries. All patients were subjected to pre anaesthetic check-up. Patients were explained about the procedure day before surgery.

Preoperative preparations

All patients were kept nil by mouth for 6 hours before Surgery ▪ 20G IV cannula inserted and IV fluids are started. Premedication: Inj Ondansetron 8mcg/kg IV is given 15 min before surgery. In Operation theatre: baseline pulse, blood pressure a, oxygen saturation and respiratory rate were recorded

Groups: Patients were randomly divided into two groups of 30 each.

Table 1:

Group A	**25 ml of 0.5% Ropivacaine [dose should not exceed the toxic dose(3mg/kg) of drug]**
Group B	25 ml of 0.5% Ropivacaine + 0.75 µg / kg of Dexmedetomidine

Technique: Under all aseptic precautions and patients in supine position, their head turned away from the side to be blocked. The high frequency probe of ultrasound machine (8-12 MHz) was positioned in parasagital plane just superior and parallel to clavicle. Subclavian artery is located crossing over the first rib between the intersections of the anterior and middle scalene muscles, posterior to the midpoint of the clavicle. The brachial plexus- superior, middle, inferior trunk can be seen as a bundle of hypoechoic round nodules just posterior and superficial to the artery.

The above drugs, according to the divided groups, are given to the patients in Supraclavicular block using 22G spinal needles under USG guidance after proper aspiration to avoid unintentional intravascular injection and pleura puncture under all aseptic precautions.

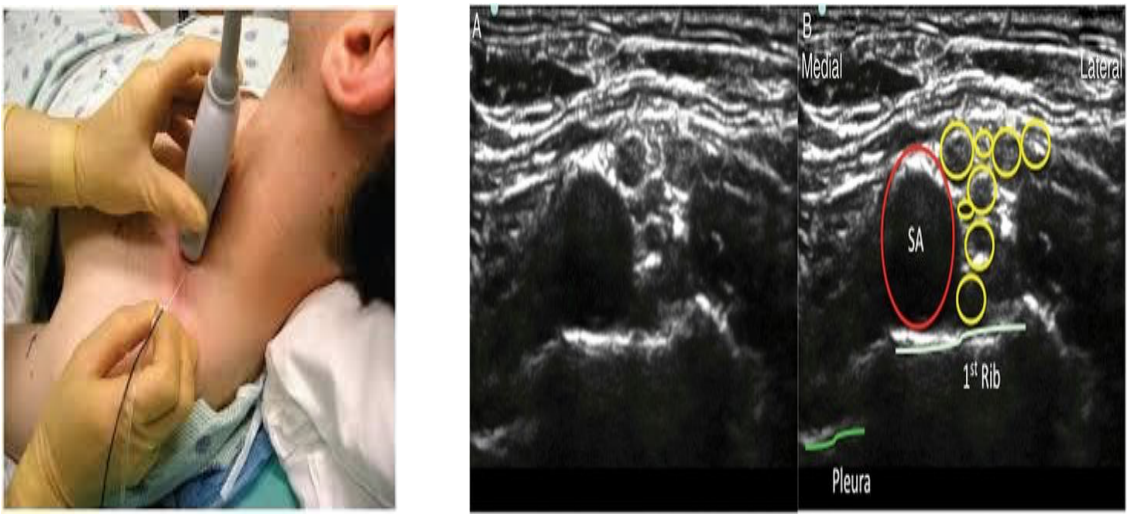

Figure 1: Ultrasound image of supraclavicular brachial plexus SA-Subclavian Artery, 1st Rib, Pleura

Table 2:

	Sensory	Motor
Grade 0	No Block (normal sensation)	Normal motor function with full flexion and extension of elbow, wrist and fingers.
Grade 1	Partial Block	Decreased motor strength with ability to move the fingers only.
Grade 2	Complete Block	Complete motor block with inability to move fingers.
Onset	Decrease of sensation to touch and pinprick to 25% or less by comparison to the contralateral limb.	The time from injection of local anaesthetic to reduction in motor power accordingly to Modified Bromage scale grade 1.
Duration	the time from onset of sensory block to recovery from pinprick sensation	the time from onset of motor block to recovery of motor function according to Modified Bromage scale. (Grade 1)

Duration of Analgesia: Duration of Analgesia was defined as the time duration from onset of Grade 1 sensory block to requirement of first rescue analgesia.

Postoperative Monitoring: Postoperative monitoring was done every half an hour till 6 hours then every 1 hourly till 10 hours, then 2 hourly till 24 hours. Post-Operative duration of sensory block, motor block and Duration of analgesia was assessed. Post-operatively patients were assessed according to visual analogue score (VAS).

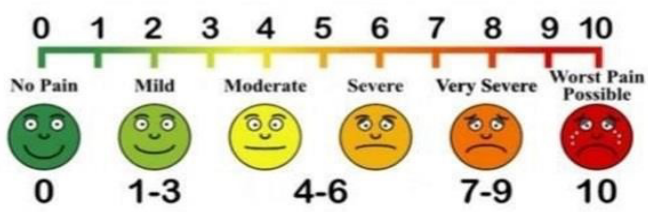

Figure 2:

Statistical Analysis: Descriptive data of both the groups were compared using unpaired 't' tests. 'P' value <0.05 was considered statistically significant and <0.001 was considered highly significant.

Table 3: Demographic data

	Group A (N=30)	Group B(N=0)	SD	Inference
Gender **Male** **Female**	 22(73.33%) 8(26.67%)	 21(70%) 9(30%)	~	~
Age(years)	38	39.33333333	0.942809042	NS
Weight(kgs)	65.23333333	64.5	0.518544973	NS

Table 4: Comparison of Mean Sensory and Motor Onset of Block

	Group A	Group B	P value
Onset of sensory block	15.82 ±1.58	8.19 ±1.34	< .00001
Onset of motor block	18.65±2.06	10.63 ±1.69	< .00001
Duration of sensory block	268.96 ±27.47 (4.48hrs)	756.29±40.84 (12.6hrs)	< .00001
Duration of motor block	344.825 ±29.07 (5.747hrs)	812.656 ±33.76 (13.54hrs)	< .00001
Duration of post op analgesia	393.036 ±28.11 (6.5506hrs)	878.149 ±30.59 (14.635hrs)	< .00001

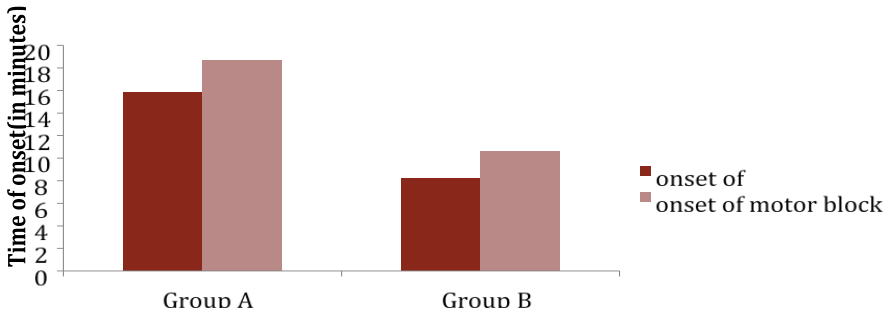

Figure 3: Mean onset Comparison of Duration of Sensory and Motor Blockade

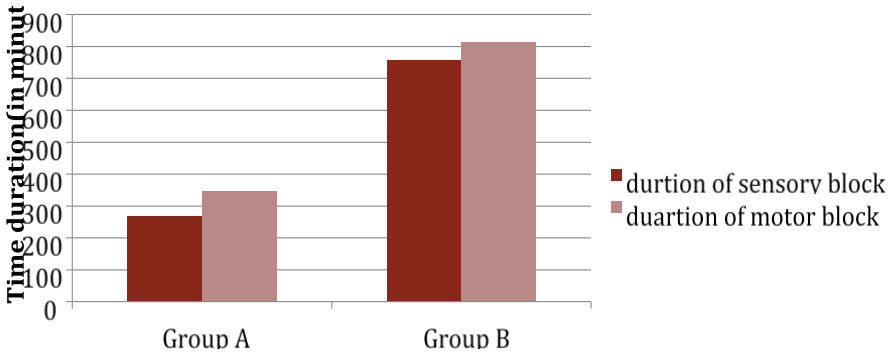

Figure 4: Duration of block Comparison of Duration of Post-OP Analgesia

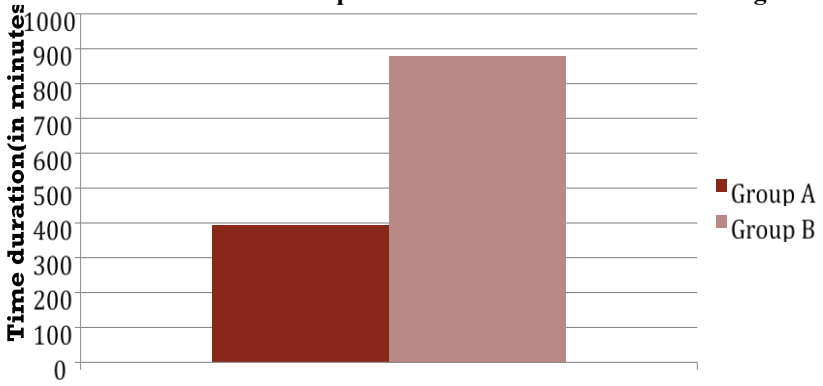

Figure 5: Duration of post op analgesia

Discussion

In our study, total duration of analgesia in group A was 393.036 ±28.11 mins (6.5506hrs), while in group B it was 878.149 ±30.59 mins (14.635hrs). Zhenqiug Liu, in their study stated The time to onset of sensory and motor nerve blockade was significantly shorter in the combination group than in the control group (8.9 min vs.12.4 min for sensation blockade; 7.5 min vs. 12.8 min for motor blockade, $P < 0.05$ for both comparisons), and the duration of the blockade was significantly longer in the combination group (590.2 min vs. 532.1 min, $P < 0.05$). There was no significant difference in VAS scores between the two groups immediately and 4 h after surgery; however, 8, 12 and 24 h after surgery, the VAS scores were all significantly lower in the combination group than the control group (2.4 vs. 3.0 for 8 h; 2.2 vs. 4.2 for 12 h, and 2.1 vs. 5.4 for 24 h, respectively, $P < 0.05$ for all comparisons). The rates of adverse reaction were significantly lower in the combination group than the control group (3.6 vs. 7.2, $P < 0.05$).

Anjan Das , in their study stated The age, sex distribution, body weight, ASA status and duration of surgery in the two groups were found to be comparable . Indications for different upper limb orthopedic surgeries were also similar and have no clinical significance ($P > 0.05$). Onset of both sensory and motor block was earlier in RD group than group R , but they were not clinically significant ($P > 0.05$). Whereas, sensory and motor block durations are significantly greater in the group receiving dexmedetomidine (RD) ($P < 0.05$) than group R

Chandresh Kumar Sudani, DNB (Anaesthesia)1; Surath Manimala Rao (Chief Intensivist)2*; Kartik Munta, (Intensivist)2 in their study stated In our

study haemodynamic parameters (HR, SBP, and DBP) were recorded at 0, 5, 10, 15, 20, 25, 30, 45 mins, 1st hr, 2nd hr and thereafter every second hourly till 24 hrs. There wasn't any incidence of fall in blood pressure more than 20 mmHg compare to baseline reading. No patient had respiratory depression, bradycardia or tachycardia. This shows that dexmedetomidine is not producing side effects like bradycardia and hypotension if it is used in small doses (less than 30 mg) as an adjuvant with local anesthetics in supraclavicular brachial plexus block.

It is evident in our study also that Group B receiving the adjuvant dexmedetomidine has faster onset of sensory and motor block, longer duration of sensory and motor block and prolong duration of analgesia than Group A without any adjuvant receiving only plain Ropivacaine.

Conclusion

From this study it can be concluded that, The use of ultrasound guidance in addition to improving success rate also reduces the complications like accidental arterial puncture, horner's syndrome, pneumothorax etc. Onset of sensory and motor block is significantly faster with Dexmedetomidine group compare to plain Ropivacaine. Duration of sensory and motor block is significantly longer than plain Ropivacaine when Dexmedetomidine is added as an adjuvant. Duration of analgesia is significantly longer with Dexmedetomidine group compare to Ropivacaine alone. There were no complications observed.

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