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Comparison of two different doses of dexmedetomidine to Ropivacaine for supraclavicular brachial plexus block

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Abstract

Objectives: The study compared the onset of sensory/motor blockade, as well as the postoperative analgesic efficacy of dexmedetomidine and Ropivacaine for brachial plexus blockade (0.75%).

Methods: The study was a single-center, prospective, randomised experiment in which patients were randomly assigned to one of two groups conducted at SVBP Hospital, which is affiliated with LLRM Medical College in Meerut. The study was done in 40 patients undergoing various elective forearm procedures under brachial plexus block via supraclavicular route.

Results: Mean sensory onset time was 7.25 ± 5.95 min in group A and 8 ± 5.71 min in group B. Mean onset time of motor block was 18.5 ± 5.15 min in group A and 14.5 ± 5.35 min in group B. Mean duration of analgesia in group A was 10.3 ± 2.93 min and in group B was 15.4 ± 5.44 min with statistically significant difference..

Conclusion: Block with a low dose of dexmedetomidine, i.e. 25µg, can be considered a better combination because the onset of sensory block was equally fast and acceptable, while the duration of analgesia was significantly low (p=0.0007) but acceptable, with the added benefit of a lower incidence of hypotension, bradycardia, and nausea than with 50µg (Group B).

Keywords: Dexmedetomidine, Ropivacaine, Supraclavicular brachial plexus block.

Introduction: The brachial plexus block is a common and widely used upper extremity regional nerve block that avoids the negative effects of anaesthetic medicines used during general anaesthesia, as well as the problems and stress of laryngoscopy and tracheal intubation. The supraclavicular brachial plexus block provides safe, effective, and low-cost full anaesthesia or analgesia of the upper extremity and is performed at the level of the brachial plexus' distal trunks/divisions.

The first instance of brachial plexus anaesthesia was in 1884, when William Halsted (1884)[1] injected cocaine into the brachial plexus nerve trunks. Hirschel (1911) was the first to conduct a percutaneous axillary brachial block. Kulenkampff pioneered the current supraclavicular method to brachial plexus block (1928). Pearson (1955) demonstrated how nerve stimulators can be used to perform nerve blocks. However, because the approach was primitive

and the apparatus was inconvenient, it did not find widespread favour. Greenblatt and Denson (1962,) created a portable transistorised nerve stimulator, which sparked interest in using nerve stimulators in regional anaesthesia[2.] Wright (1969) introduced the Block- Aid nerve block monitor, which popularised the procedure and made it more accessible[3]. Nerve stimulation used to be done using non-insulated needles, but now it's more common to utilise insulated needles. The use of the Doppler probe to identify arteries, which aids in the location of the brachial plexus, was documented by La Grange (1978). With the first recorded ultrasound imaging of the brachial plexus in the supraclavicular region and needle insertion under ultrasound guidance, Kapral et al[4] expanded on that idea. The block was subsequently performed using both ultrasound and nerve stimulation, according to Vincent Chan.

Ropivacaine is a long-acting amide local anaesthetic that causes differential sensory nerve block, dose-dependent motor blockade, and a better cardiac profile.[5] Bupivacaine and ropivacaine are structurally similar. When compared to racemic bupivacaine, ropivacaine has less central nervous system and cardiac toxicity and is more well tolerated. Ropivacaine may be superior than bupivacaine based on its profile. The efficacy of ropivacaine is a source of debate: in certain locations, it is plainly less effective, while in others, it is less obvious. In peripheral nerve blocks, however, ropivacaine alone does not give analgesia for longer than 4-8 hours. Increasing the duration of local anaesthetic effect is frequently desired because it extends surgical anaesthesia and analgesia.

Dexmedetomidine is a highly selective agonist of the α2 adrenoceptor that has sedative and analgesic properties.[6] Dexmedetomidine has a α2:α1 adrenoreceptor ratio of roughly 1600:1 when compared to clonidine. Dexmedetomidine administered to ropivacaine has been proven in studies to extend the duration of analgesia. For its calming, analgesic, perioperative sympatholytic, and cardiovascular stabilising actions with reduced anaesthetic requirements, α2 adrenergic receptor agonists have piqued attention. Moreover, several administration routes, such as epidural, intrathecal, and peripheral injections, have been attempted alone or in conjunction with another medicine to prolong and deepen anaesthesia. In prior clinical research, intravenous dexmedetomidine resulted in significant opioid sparing as well as a reduction in the need for inhalational anaesthesia. This study compared the onset of sensory/motor blockade, as well as the postoperative analgesic efficacy of dexmedetomidine and Ropivacaine for brachial plexus blockade (0.75%).

Materials and Methods: This study was conducted at SVBP Hospital, which is affiliated with LLRM Medical College in Meerut, after receiving clearance from the institutional ethical committee and written informed consent from the patients. The study was a single-center, prospective, randomised experiment in which patients were randomly assigned to one of two groups (using a sealed envelope technique). In the department of anesthesiology at LLRM Medical College Meerut, a trial was done in 40 patients undergoing various elective forearm procedures under brachial plexus block via supraclavicular route.

Patients were assigned in group A and group B.

Group A: Received brachial plexus block with 30 ml of 0.75% Ropivacaine (3mg/kg)+ .25ml Dexmedetomidine (25microgram)

Group B: Received brachial plexus block with 30 ml of 0.75% Ropivacaine (3mg/kg)+ .5ml Dexmedetomidine (50microgram).

Inclusion criteria

- ASA class I, II.
- 18–60 years of age.

- Elective upper limb surgery.

Exclusion criteria

- Any major systemic illness.
- Pediatrics, geriatric age group.
- Contraindication to supraclavicular block.
- History of drug allergy/ drug addiction.
- Pregnant females.

Monitoring

Following parameters were recorded before the start of procedure:

- Heart Rate
- Blood Pressure (NIBP) –SBP, DBP & MAP
- Oxygen saturation

After initial monitoring of patients vitals, an intravenous line was secured in the unaffected limb and Ringers lactate was started. Patient was premedicted with injection Midazolam.04mg/kg(i.v), injection Ondansetron 4mg (i.v) before brachial block via the peripheral vein.

Supraclavicular approach (classical / perivascular) brachial plexus block was conducted with patients in supine position under aseptic conditions. The arm was adducted with the hand extended towards the ipsilateral knee and the head was turned away from the side to be blocked by 45 degrees. To get the plexus taut, insert a thin roll of towel between the shoulder blades. The clavicle's middle section was identified and marked. The lateral border of the anterior scalene muscle, about 1.5 to 2 cm posterior to the midpoint of the clavicle, was also noted as the location of entry. The subclavian artery can be palpated at this location to confirm the landmark. Local anaesthetics were used to elevate a skin wheal. In the caudal-posterior-medial (CPM) direction, a 24-1'1/2G needle was placed at the point of entry above the middle of the clavicle. Paraesthesia was evoked in the forearm or hand. Following a negative air or blood aspiration, the required medications were delivered. All of the important values were compared to those obtained immediately after the block injection.

The time interval between the conclusion of total local anaesthetic administration and complete sensory block was described as sensory onset time (score 2). The time interval between the completion of local anaesthetic injection and the complete resolution of sensory block was defined as the duration of sensory block. Sensory and motor blocks were assessed every 5 minutes for the next 30 minutes. A pinprick test was used to assess sensory block on a 3-point scale.

0 = normal sensation
1 = loss of sensation of pinprick (analgesia),
2 = loss of sensation of touch (anesthesia).

Motor block was evaluated by Modified Bromage Scale

4 = Full strength in relevant muscle groups.
3 = Strength reduction, but able to move against resistance.
2 = Ability to move against gravity, but not against resistance.
1 = Discrete movements (trembling) of muscle group,
0 = absence of movements.

The duration of motor block was defined as the time interval between the end of the local anaesthetic injection and the recovery of full power in the relevant muscle group (Modified Bromage Scale 4). The Visual Analogue Score was used to evaluate the quality of intraoperative

analgesia at the end of the procedure. It consists of a 100-mm-long line with two descriptors at each end indicating pain intensity extremes (e.g., no pain and worst imagined pain).

Lethargy, pruritus, nausea/vomiting, and other sequelae were common in patients who received a brachial plexus block. Patients were asked if they had any procedure-related issues such Horner's syndrome, phrenic nerve palsy, or pneumothorax, and they were checked for respiratory depression and signs and symptoms of local anaesthetic toxicity. The principal investigator, who was uninformed of the drugs utilised in the brachial plexus block, did the above evaluations.

Results: There were 7 (35%) subjects in group A who were 18-30 years old, 6 (30%) subjects who were 31-45 years old, and 7 (35%) subjects who were 46-60 years old. There were 14 (70%) subjects in group B who were 18-30 years old, 4 (20%) subjects who were 31-45 years old, and 2 (10%) subjects who were 46-60 years old. The average age of the subjects in Group A was 37.45±12.55 years, while the average age of the subjects in Group B was 30.7±12.83 years. When the data was compared statistically, there was no significant difference between the two groups (p=0.1148). Majority of subjects in both the group were male. There were 17(85%) male in Group A and Group B. Mean weight of subject in Group A was 54.3±4.16kg as against 55.6±3.2 kg in Group B.

Table 1 showed the comparison of two groups for heart rate at different time intervals. It showed that the heart rate in both the groups was increasing and then decreasing every 15 minutes. There was no significant difference seen among the two groups.

Table 1: Comparison of two groups for heart rate at different time intervals

Time in min	**Group A**		**Group B**		**p value**
	Mean	**SD**	**Mean**	**SD**	
Baseline	85.9	7.66	87.4	9.27	0.5803
15	84.2	8.65	77	14.06	0.0586
30	80.6	12.58	89.35	9.98	0.0196
45	78.88	12.39	87.84	7.60	0.0116
60	79.62	12.33	87.25	7.89	0.0459
75	83.66	14.56	89.33	11.07	0.4160
90	-	-	-	-	-
120	-	-	-	-	-

Table 2 showed the comparison of two groups for SBP at different time intervals. It showed that the SBP in both groups was increasing and then decreasing every 15 minutes. There was no significant difference seen among the two groups.

Table 2: Comparison of two group for SBP at different time interval

Time in min	**Group A**		**Group B**		**p value**
	Mean	SD	Mean	SD	
Baseline	122.1	5.89	119.05	15.83	0.4246
15	125	11.24	110.5	13.34	0.0007
30	120.7	11.70	120.65	9.86	0.9884
45	122.55	17.97	118.94	8.87	0.4403
60	120.12	11.27	116.06	9.11	0.2712
75	119.83	17.81	116.66	8.73	0.6894

90	-	-	-	-	-
120	-	-	-	-	-

Table 3 showed the comparison of two groups for DBP at different time intervals. It showed that the DBP in both the groups was increasing and then decreasing every 15 minutes. There was no significant difference seen among the two groups.

Table 3: Comparison of two groups for DBP at different time interval

Time in min	**Group A**		**Group B**		**p value**
	Mean	SD	Mean	SD	
Baseline	79.5	5.26	76.85	6.06	0.1483
15	80.3	3.19	72.45	9.40	0.0011
30	78.7	6.19	80.4	8.29	0.4675
45	77.55	9.31	74.31	14.77	0.4334
60	76.75	7.22	76.12	8.34	0.8223
75	77	6.68	74.33	5.12	0.4055
90	-	-	-	-	-
120	-	-	-	-	-

Table 4 showed the mean onset of sensory and motor block score in both the groups. Mean sensory onset time was 7.25 ± 5.95 min in group A and 8 ± 5.71 min in group B. Mean onset time of motor block was 18.5 ± 5.15 min in group A and 14.5 ± 5.35 min in group B.

Table 4: Mean onset of sensory and motor block in both group

Group	**Mean sensory onset time (min)**	**SD**	**Mean Motor onset time (min)**	**SD**
A	7.25	5.95	18.5	5.15
B	8	5.71	14.5	5.35

Table 5 showed a comparison of duration of analgesia in both the groups. Mean duration of analgesia in group A was 10.3 ± 2.93 min and in group B was 15.4 ± 5.44 min with statistically significant difference. Out of total, 5% require GA in group A and 10% require GA in group B. Fentanyl was required by 10% participants in group A and 5% participants in group B. Ephedrine and Atropine were required only in group B (10% and 25% respectively).

Table 5: Compare the duration of Analgesia and supplementation require for upper limb surgery in both the group

Variables	**Group A**		**Group B**		**P value**
	Mean	SD	Mean	SD	
Duration of Analgesia	10.3	2.93	15.4	5.44	<0.0007
Supplementation	**N**	**%**	**N**	**%**	
General Anaesthesia	1	5	2	10	0.026
Fentanyl	2	10	1	5	
Ephedrine	0	0	2	10	
Atropine	0	0	5	25	

Discussion: Site-specific, long-lasting, and effective anaesthesia and analgesia are possible with regional anaesthesia. Various adjuncts, such as dexmedetomidine, have been used with local anaesthetics to prolong perioperative analgesia. We compared the time of onset of sensory and motor block, as well as the duration of analgesia, in two groups. In our research, each patient in each group received the same amount of medications through supraclavicular injection for brachial plexus block. We evaluated two different dosages of dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block in this randomised, double-blind experiment and observed a substantial decrease in onset time and an increase in duration of analgesia in both groups.

Dr. Nikhil Yadav et al. (2010)[7] looked at 40 patients who had supraclavicular brachial plexus blocking during elective and emergency upper limb procedures. In one group, patients were given injections of Ropivacaine 0.75 percent (3mg/kg) diluted in normal saline up to 40ml. Patients in the other group got injections of Ropivacaine 0.75 percent (3 mg/kg), dexmedetomidine 1 mg/kg, inj. Hylase (1500IU), and normal saline to form a total volume of 40 ml in both groups. Based on statistical data, they discovered that there was no significant difference in demographic data or surgery time between the two groups.

Dr. Sarita S Swami et al.[8] examined clonidine and dexmedetomidine as an adjuvant to local anaesthetic agent in supraclavicular brachial plexus block in terms of start and duration of sensory and motor block, as well as duration of analgesia. In a randomised, double-blinded study, sixty ASA I and II patients were scheduled for elective upper limb procedures under supraclavicular brachial plexus block and allocated into two equal groups.

Conclusion: We concluded that greater doses of dexmedetomidine (50µg) resulted in a faster onset of motor block and longer duration of analgesia, but also a higher incidence of complications and side effects such hypotension and bradycardia. Block with a low dose of dexmedetomidine, i.e. 25µg, can be considered a better combination because the onset of sensory block was equally fast and acceptable, while the duration of analgesia was significantly low (p=0.0007) but acceptable, with the added benefit of a lower incidence of hypotension, bradycardia, and nausea than with 50µg (Group B). The majority of upper-limb procedures are done in within two hours. Dexmedetomidine (25µg) had much fewer systemic adverse effects in group A, therefore we may assume that this is the best dose with ropivacaine for brachial plexus block.

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