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ORIGINAL ARTICLE

EFFECT OF ADDITION OF DEXMEDETOMIDINE TO ROPIVACAINE HYDROCHLORIDE (0.75%) IN BRACHIAL PLEXUS BLOCK THROUGH SUPRACLAVICULAR ROUTE IN UPPER LIMB SURGERIES: A CLINICAL COMPARATIVE STUDY

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ABSTRACT: Brachial plexus block is a popular and widely employed regional nerve block of upper extremity which avoids the unwanted effect of anesthetic drugs used during general anesthesia, there complication and the stress of laryngoscopy and tracheal intubation. Patients also have a post-operative period free from nausea, vomiting, cerebral depression and immediate post-operative pain. The brachial plexus via supraclavicular approach block provide safe, effective, low cost complete anesthesia or analgesia of the upper extremity and is carried out at the level of the distal trunks/divisions of the brachial plexus, where it is in its tightest formation thus allowing for rapid and completed anesthesia or analgesia of the upper limb. The present single Centre, prospective, randomized, double blind study was undertaken to compare the effects of Ropivacaine and Ropivacaine-Dexmedetomidine combination in brachial plexus block via supraclavicular route with respect to its onset, duration of action. A total of 60 patients of ASA grading I &II and age ranging 18-50 year of either sex underwent various elective upper limb surgeries were divided in two equal groups Group A (n=30): Received brachial plexus block with 30 ml Ropivacaine (0.75%.) Group B (n=30): Received brachial plexus block with 29 ml Ropivacaine (0.75%) + 1 ml Dexmedetomidine (50µg.) After performing supraclavicular block the following observations were made: 1. Onset of sensory blockade. 2. Duration of sensory blockade. 3. Onset of motor blockade. 4. Duration of motor blockade. 5. Duration of analgesia. The onset and duration of sensory blockade was assessed by pin prick response on area of all four nerves of upper limbs. The onset and duration of motor blockade was assessed by Modified Bromage Scale. The onset and duration of analgesia was assessed by response to pin prick and time of first request of analgesic dose. The observations were as follow: - The average time of onset of sensory blockade was 14.20 ±5.229 mins in-group A and 7.20±2.483 mins in-group B. The observed average onset of motor blockade was 21.00±8.566 mins in group A and 11.83±3.824 mins in group B. The average duration of sensory blockade was 310.37±66.359 mins in group A and 435.87±102.309 mins in group B respectively. The average duration of motor blockade was 278.50 ±66.887 mins in group A and 390.47 ±107.868 mins in group B. The average duration of analgesia was 378.53±80.93 min and 970.83±237.623 mins in groups A and B respectively. There was statistical significant difference in terms of onset & duration of sensory, motor blockade and duration of analgesia between the two groups.

KEYWORDS: Brachial plexus block, Ropivacaine, Dexmedetomidine, Visual analogue score, and Modified Bromage scale.

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INTRODUCTION: Brachial plexus block is a popular and widely employed regional nerve block of upper extremity which avoids the unwanted effect of anesthetic drugs used during general anesthesia, there complication and the stress of laryngoscopy and tracheal intubation. The brachial plexus via supraclavicular approach block provide safe, effective, low cost complete anesthesia or analgesia of the upper extremity and is carried out at the level of the distal trunks/divisions of the brachial plexus.

Ropivacaine, a long acting amide local anesthetic causes differential sensory nerve block, with a dose-dependent motor blockade and a safer cardiac profile.[1] Dexmedetomidine is a highly selective α2 adrenoceptor agonist that has been shown to have both sedative and analgesic effects.[1,2] Compared with clonidine, dexmedetomidine has a α2:α1 adrenoreceptor ratio of approximately 1600:1 (seven to eight times higher than clonidine).[3] Multiple clinic studies have reported that clonidine prolongs the duration of anesthesia and analgesia in peripheral nerve blocks.[4-7]

Only a few clinical studies have reported the administration of dexmedetomidine in combination with bupivacaine and levobupivacaine but not with ropivacaine.[8-15] Animal studies show that dexmedetomidine added to ropivacaine increases the duration of analgesia.[16,17] This study has been conducted to compare the onset and duration of sensory/motor blockade, postoperative analgesic efficacy of Dexmedetomidine for brachial plexus blockade along with Ropivacaine 0.75%.

METHODS: The study was a single centre, prospective, randomized, double-blinded trial conducted in 60 patients undergoing various elective forearm surgeries under brachial plexus block via supraclavicular approach in department of anesthesiology MGM Medical college Indore after taking permission from institutional ethical committee. The patients were of ASA grade I–II, of either sex, between 18–50 years of age was randomly divided in two equal groups of 30 patients each and patients underwent a thorough preanaesthetic checkup. Patients with history of any significant medical history, pregnancy and lactation, drug allergy, local infection at the site of block, drug or alcohol abuse, Patchy or inadequate Anesthesia are excluded from the study.

Standard monitoring was maintained (electrocardiography, pulse oximetry, and automated sphygmomanometry; Cardiocap II, Datex) after the patient entered into the operating room. And patients were premedicated with inj. Midazolam.04mg/kg (i.v), inj Glycopyrolate.004 mg/kg (i.v) and inj. Ondansetron 4mg (i.v) before brachial block via the peripheral vein, which was located on the contralateral arm by a 20-gauge cannula. Next, the basic blood pressure, heart rate and SpO_2 were recorded.

Patients were assigned in group A and group B. Group A: Received brachial plexus block with 30 ml of Ropivacaine 0.75%. Group B: Received brachial plexus block with 29 ml Ropivacaine 0.75%+1ml Dexmedetomidine (50 microgram). The anesthetic solution was prepared by an anesthesiologist who was not involved in the study, and the anesthesiologist who performed the block was also blinded to the treatment groups

Under aseptic precautions brachial plexus block was performed by Supraclavicular approach (classical / perivascular) with patients placed in supine position. The head was turned away 45^0 from the side to be blocked and the arm adducted with hand extended towards the ipsilateral knee. A small roll of towel placed between the shoulder blades to make the plexus taut. The mid portion of the clavicle was identified and marked.

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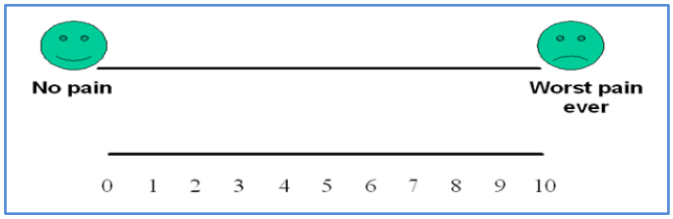
The point of entry was the lateral border of anterior scalene muscle, approximately 1.5 to 2 cm posterior to the midpoint of clavicle was also marked. One can confirm the landmark by palpating the subclavian artery at this point. A skin wheal was raised with local anesthetics. 24-1'1/2G needle was inserted at the point of entry above the midpoint of clavicle in the caudal-posterior-medial (CPM) direction. Parasthesia in the forearm or hand was elicited. After negative aspiration for air or blood appropriate drugs were injected.

The following parameters were observed:

1. Onset of sensory blockade (min).
2. Onset of motor blockade (min).
3. Duration of sensory blockade (min).
4. Duration of motor blockade (min).
5. Duration of analgesia (min).

ONSET OF ANALGESIA: This was recorded by subjective feeling of heaviness, tingling and numbness of the limb after deposition of local anaesthetic drugs; skin was pricked with 26 gauge needle every 5 minute up to 30 min to test the superficial analgesia. The intensity of pain was assessed using visual analogue scale (vas) score. This scale consists of a line, 10 cm long, with verbal anchors at either end. In the numerical scale, 0 corresponds to no pain and 10 designate the worst possible pain. Patients are asked to choose a point on the line that represents the intensity of their current state.

VISUAL ANALOGUE SCALE (VAS):



TIME OF ONSET OF COMPLETE SENSORY BLOCKADE: Defined as time between injection and total abolition of pinprick response, was evaluated in four nerve areas (radial, ulnar, median and musculocutaneous) at every 5 minutes until 30 minutes after the injection. The block was judged to be failed if anesthesia was not present in 2 or more peripheral nerve distribution and such patients were excluded from the study.

THE DURATION OF SENSORY BLOCKADE: Defined as the time between onset of action and return of pinprick response was assessed every 30 minutes in at least 3 major nerve territories followed by evaluated post-operatively, every hourly for first six hours, second hourly for next twelve or more hours.

THE TIME OF ONSET OF COMPLETE MOTOR BLOCKADE: Defined as time between injection and abolition of upper limb movement or ability to flex & extend only finger evaluated by Modified

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Bromage Scale. The block was assessed every 5 minutes for first 30 minute and judged to be failed if MBS score < 2.

Modified Bromage scale:

0- Normal motor function,
1- Ability to flex & extend wrist &fingers
2- Ability to flax & extend only fingers,
3- Complete motor block with inability to move elbow, wrist and finger.

The duration of motor blockade: Recovery of motor blockade was evaluated by Modified Bromage Scale.

The duration of analgesia: Defined as the time between the onset of action and the onset of pain, was the time when the patients received the first dose of analgesic. Supplemental analgesia was given in the form of intramuscular inj Diclofenac sodium 75 mg, when visual analogue scale score was more than 4. For statistical analysis Stats direct, a Window based programme was used. Data were analysed using unpaired "t" test. A 'p' value of <0.05 was considered statistically significant.

RESULTS: Study Design: A prospective, randomized, comparative study consisting of 30 patients in Group A and 30 patients in Group B is undertaken to study the effect of adding dexmedetomine with ropivacaine (.75%) on onset and duration of block. The following observation were made

Demographic parameters Mean ± SD	Group A (n=30)	Group B (n=30)
Age in years	29.63±11.33	30.4±11.509
Sex	Male=22 (73.33%)	Male=21 (70.0%)
	Female=8 (26.66%)	Female=9 (30.0%)

Table 1: Comparison of demographic parameters

Both the groups are comparable with respect to age and sex distribution.

The above table shows that the average age was 29.63±11.33 yrs in-group A and 30.4±11.509 yrs in-group B. Both groups had predominantly male patients; there was no significant difference in age, and sex distribution between two groups and both the groups were comparable.

Study Parameter	Group A (n=30)		Group B (n=30)		P Value
	Mean	SD	Mean	SD	
Onset of Sensory blockade (min)	14.20	5.229	7.20	2.483	<0.0001
Duration of Sensory blockade (min)	310.37	66.359	435.87	102.309	<0.0001
Onset of motor blockade (min)	21.00	8.566	11.83	3.824	<0.0001
Duration of Motor Blockade (min)	278.50	66.887	390.47	107.868	<0.0001
Duration of analgesia (min)	378.53	80.933	970.83	237.623	<0.0001

Table 2: Comparison of Study parameters between two groups

p value <0.0001 which is highly significant.

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In the above chart the average time of onset of sensory blockade was 14.20 ±5.229 mins in-group A and 7.20±2.483 mins in-group B. The observed average onset of motor blockade was 21.00±8.566 mins in group A and 11.83±3.824 mins in group B. The average duration of sensory blockade was 310.37±66.359 in group A and 435.87±102.309 mins in group B respectively. The average duration of motor blockade was 278.50 ±66.887 mins in group A and 390.47 ±107.868 mins in group B. P value was calculated using unpaired student t- test, the average duration of analgesia was 378.53±80.933 mins and 970.83±237.623 mins in groups A and B respectively with the p value of <0.0001. It showed highly statistically significant difference in terms of onset & duration of sensory, motor blockade and duration of analgesia between the two groups.

DISCUSSION: Regional anesthesia enables site-specific, long-lasting, and effective anesthesia and analgesia. It is suitable for many surgical patients and can improve analgesia, reduce morbidity, mortality. A large number of researches have been done and many drugs evaluated since ancient time. Search for long acting local anesthetic is great and wide spread. Supremacy of lignocaine remains unchallenged in spite of introduction of various local anesthetics. But it has got short duration of action and increases risk of over dose and toxicity.

To prolong perioperative analgesia various adjuncts such as Opioids, Clonidine, Verapamil, Steroids, Neostigmine and Tramadol have been tried. In our study we compared time of onset of sensory and motor block, duration of sensory and motor block and duration of analgesia between two groups. The pH of the injected solution and concentration of drug around the nerve would certainly influence the onset of action. In this study each patient of different groups had received in total equal volume of drugs through supraclavicular approach for brachial plexus block.

Our findings are comparable with the study conducted by Dr. Nikhil Yadav et al (2011) [18] in 40 patients undergoing elective and emergency upper limb surgeries under supraclavicular brachial plexus blockade. Group A received injection Ropivacaine 0.75% 3mg/kg diluted upto 40ml with normal saline. Group B received injection Ropivacaine 0.75% 3mg/kg plus injection Dexmedetomidine 1µg/kg, inj Hylase 1500 IU and normal saline to make total volume of 40 ml was added to both group. They found that based on statistical data; there was no significant difference in the demographic data and duration surgeries in the two groups.

There was no statistically significant difference in time of onset of sensory and motor block between the two groups. However peak sensory time in Ropivacaine (R) group (8.36±2.06 min) was significantly shorter than Ropivacaine plus Dexmedetomidine (RD) group (15.07± 4.35 min). Similarly peak motor time was shorter in R group (16±1.48 min) than RD group (26.47±7.51 min) &. The duration of sensory blockade was statistically highly significantly longer in RD group (750±129.62 min) than R group (350±102.51). Similarly duration of motor block was also highly significantly longer in RD group (615.33±118.98 min.) as compared to R group (275.45±111.66 min.). Duration of analgesia was significantly prolonged in RD group (783±128.32 min).

They concluded that Dexmedetomidine added to Ropivacaine for brachial plexus block extends the motor and sensory block duration as well as duration of analgesia. Our findings are also comparable with the study conducted by Dr. Sarita S Swami et al (July 2012)[19] They studied that Alpha-2 agonists are mixed with local anesthetic agents to extend the duration of spinal, extradural and peripheral nerve blocks and they compared clonidine and Dexmedetomidine as an adjuvant to local anesthetic agent in supraclavicular brachial plexus block with respect to onset and duration of

sensory and motor block and duration of analgesia. Sixty ASA I and II patients were scheduled for elective upper limb surgeries under supraclavicular brachial plexus block and divided into two equal groups in a randomized, double-blinded fashion.

Group C received clonidine 1 μg/kg and Group D received Dexmedetomidine 1 μg/kg added to Bupivacaine 0.25% (35 cc). Onset and recovery time of sensory and motor block, duration of analgesia and quality of block were studied in both the groups. The results found were that duration of sensory block and motor block were 227.00±48.36 and 292.67±59.13 min, respectively in group C, while it was 413.97±87.13 and 472.24±90.06 min, respectively in group D. There was no statistically significant difference in onset of sensory and motor block between the two groups.

The duration of analgesia (time to requirement of rescue analgesia) in group D was 456±97 min, while in group C, it was 289±62 min. statistically, this difference was significant (P=0.001). The number of patients achieving grade IV quality (excellent) of block was higher in group D (80%) as compared with group C (40%) (P<0.05). They concluded that the Dexmedetomidine when added to local anesthetic in supraclavicular brachial plexus block enhanced the duration of sensory and motor block and also the duration of analgesia. It also enhanced the quality of block as compared with clonidine.

In our study we found that the average age of the patients was 29.63±11.33 yrs in-group A and 30.4±11.509 yrs in group B. Both groups had predominantly male patients. There was no significant difference in age, and sex distribution. The average time of onset of sensory blockade was 14.20 ±5.229 min in group A and 7.20±2.483 min in group B this difference was significant (P=0.0001). The observed average onset of motor blockade was 21.00±8.566 min in group A and 11.83±3.824 min in group B (P=0.0001). The average duration of sensory blockade was 310.37±66.359 in group A and 435.87±102.309 min in group B respectively (P=0.0001).

The average duration of motor blockade was 278.50 ±66.887 in group A and 390.47 ±107.868 min in group B (P=0.0001). The average duration of analgesia was 378.53±80.933 min and 970.83±237.623 min in groups A and B respectively (P=0.0001). There was statistical significance in terms of onset & duration of sensory, motor blockade and duration of analgesia between the two groups. Brachial plexus block is an easy and relatively safe procedure for upper limb surgery.

The present study indicates that Dexmedetomidine added to the local anesthetic Ropivacaine injected in performing supraclavicular brachial plexus block thus provides prolonged post-operative analgesia and markedly reduces the rescue analgesia in both the early and late post-operative period. Dexmedetomidine prolonged the surgical anesthesia and extended duration of analgesia as well as shortened the onset of sensory and motor blockade significantly.

CONCLUSION: The randomized comparative clinical study of Brachial plexus block with local anesthetics Ropivacaine hydrochloride (0.75%), with and without Dexmedetomidine has revealed that addition of Dexmedetomidine (50μg) to local anesthetic Ropivacaine provided early onset as well as complete blockade of sensory and motor nerves and prolonged duration of analgesia in comparison to other group so Dexmedetomidine group appeared to be better than the other group.

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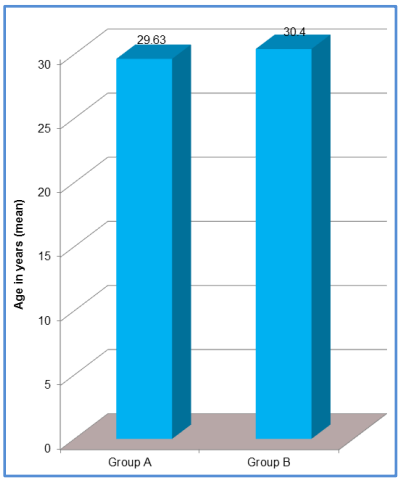

Fig. 1: Comparison of Age Distribution Between the two Groups

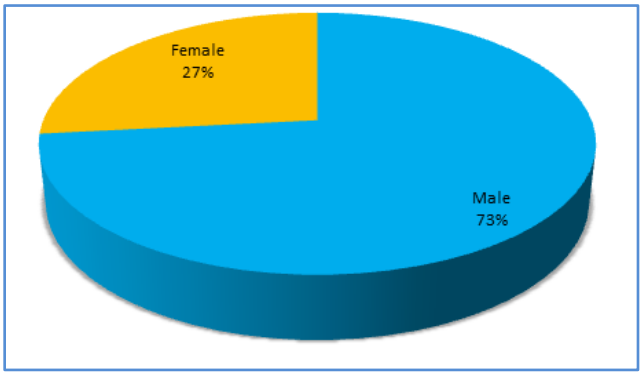

Fig. 2: Comparison of Sex Distribution Between The Two Groups

GROUP A:

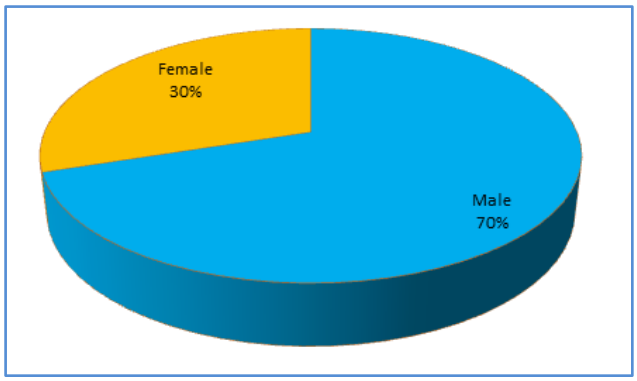

Fig. 3: Comparison of Sex Distribution between the Two Groups

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GROUP B:

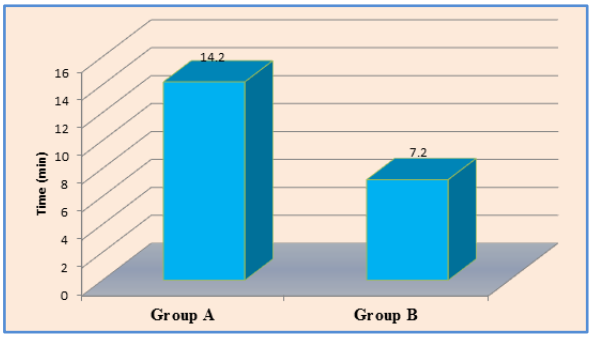

Fig. 4: Comparison of Onset of Sensory Blockade (Mean Time) Between Two Groups

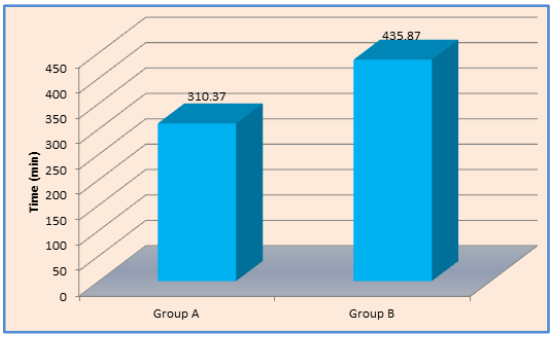

Fig. 5: Comparison of Duration Of Sensory Blockade (Mean Time) Between Two Groups

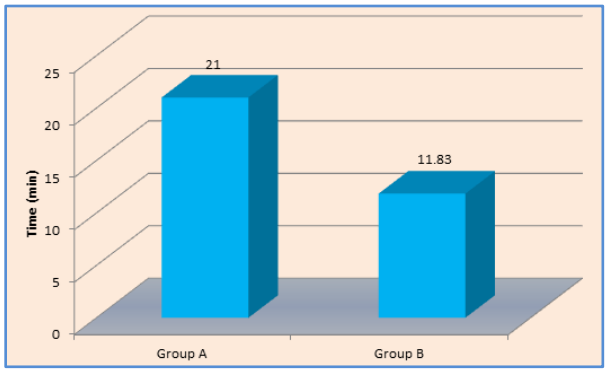

Fig. 6: Comparison of Onset of motor blockade (mean time) between two groups

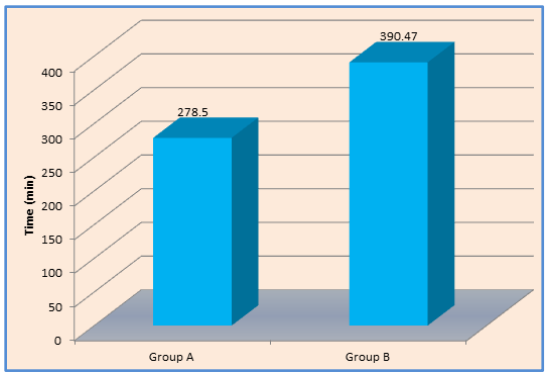

Fig. 7: Comparison of Duration of motor blockade (mean time) between two groups

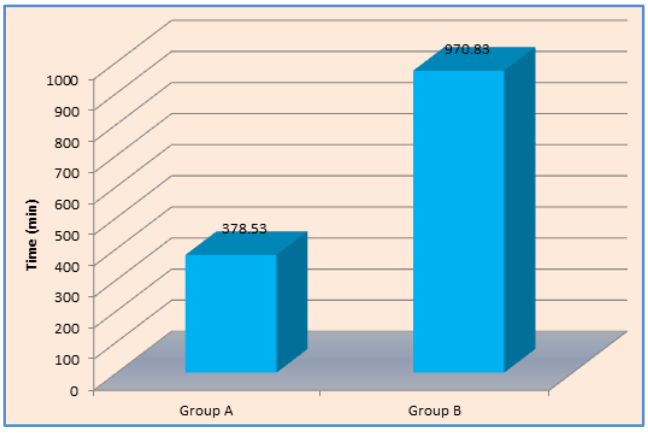

Fig. 8: Comparison of Duration of analgesia (mean time) between two groups

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