

## Comparative Study of Ropivacaine with Dexmedetomidine versus Ropivacaine Alone In Supraclavicular Brachial Plexus Block for Upper Limb Surgery

<sup>1</sup>Dr. Veena Horo, Associate Professor, Dept. of Anaesthesiology, JLN medical College, Bhagalpur

<sup>2</sup>Dr. Kumar Shailesh, Resident, Dept. of Anaesthesiology, JLN medical College, Bhagalpur

<sup>3</sup>Dr. Mahesh Kumar, Assistant Professor, Dept. of Anaesthesiology, JLN medical College, Bhagalpur

<sup>4</sup>Dr. Niranjana Kumar Verma, Professor and Head, Dept. of Anaesthesiology, JLN medical College, Bhagalpur

**Correspondence Author:** Dr. Kumar Shailesh, Resident, Dept. of Anaesthesiology, JLN medical College, Bhagalpur

**Type of Publication:** Original Research Paper

**Conflicts of Interest:** Nil

### Abstract

**Background and Aims:** Supraclavicular plexus block, as a regional anaesthesia has taken over as principal technique for upper limb surgeries. Different additives have been used to prolong brachial plexus block. Dexmedetomidine has been reported as an effective adjuvant for regional anesthetic agents. The present study was conducted to compare and evaluate the effectiveness of ropivacaine with dexmedetomidine versus ropivacaine alone in supraclavicular brachial plexus block for upper limb surgeries. The primary endpoints were the onset and duration of sensory and motor block and duration of analgesia, hemodynamics and side-effects.

**Materials and Methods:** A total of 80 patients (20-55 years) posted for elective forearm and hand surgery under supraclavicular brachial plexus block were divided into two equal groups (Group R and RD) in a randomized, double-blinded fashion. Group R: 0.50% Ropivacaine (30 cc) + 0.5 ml normal saline and Group RD: 0.50% Ropivacaine (30 cc) + Dexmedetomidine 50 µg. Both groups were compared for complete onset time and total duration of sensory blockade, complete onset time and total duration of motor blockade, total duration of analgesia, hemodynamics and side-effects.

**Results:** Though with similar demographic profile in both groups, sensory and motor block in group RD ( $P < 0.05$ ) was earlier than group R. Sensory and motor block duration and time to first analgesic use were significantly longer in group RD ( $P < 0.05$ ) than group R. Intra-operative hemodynamics were comparable in both groups without any appreciable side-effects. The mean onset time for a complete sensory block in Group R was  $19.89 \pm 7.86$  min, in Group RD was  $16.72 \pm 4.76$  min ( $P = 0.001$ ) and the mean onset time for complete motor block in Group R was  $22.46 \pm 3.92$  min, and in Group RD was  $20.68 \pm 2.85$  min ( $P = 0.00001$ ) which were statistically significant. The mean duration of sensory block in Group R was  $639.89 \pm 78.86$  min and in Group RD was  $806.72 \pm 48.76$  min and the mean duration of motor block in Group R was  $515.67 \pm 173.92$  min, and in Group RD was  $636.95 \pm 132.85$  min which were statistically significant ( $P = 0.00001$ ). The mean duration of analgesia in Group R was  $286.34 \pm 66.35$  min and in Group RD was  $403.83 \pm 81.43$  min which was statistically significant ( $P = 0.00001$ ).

**Conclusion:** It can be concluded that adding dexmedetomidine to supraclavicular brachial plexus block hasten onset of sensory and motor block, increases the sensory and motor block duration and time to first

analgesic use, and decreases total analgesic use with no side-effects.

**Keywords:** Dexmedetomidine, Ropivacaine, Supraclavicular brachial plexus block

### **Introduction**

Peripheral nerve block as an anaesthetic technique plays an important role in modern regional anesthesia. Regional anaesthesia is particularly indicated for patients undergoing peripheral limb surgery because it provides effective intraoperative anaesthesia and post-operative pain control. Brachial plexus block is a versatile and reliable regional anaesthetic technique and a suitable alternative to general anaesthesia for upper limb surgical procedures. Peripheral nerve blocks not only provide intra-operative anaesthesia, but also extend analgesia in the post-operative period without major systemic side-effects by minimizing stress response and using minimal anaesthetic drugs<sup>[1]</sup>.

Ropivacaine is long acting local anaesthetic drug belonging to amino amide group. They are pure S(-) enantiomer, unlike Bupivacaine which is racemate. It is less cardiac and central nervous system toxic than other long acting local anaesthetics like Bupivacaine<sup>[2]</sup>. Local anaesthetics alone for supraclavicular brachial plexus block provide good operative conditions, but have a shorter duration of postoperative analgesia. Hence, various adjuvants such as Opioids<sup>[3]</sup>, Clonidine<sup>[4]</sup>, Neostigmine, Dexamethasone<sup>[5]</sup>, etc., were added to local anaesthetics in brachial plexus block to achieve quick, dense and prolonged block, but the results are either inconclusive or associated with side-effects.

Dexmedetomidine is highly selective (8 time more selective than Clonidine)<sup>[6]</sup>, specific and potent  $\alpha_2$ -adrenergic agonist having analgesic, sedative, antihypertensive, and anaesthetic sparing effects when used in systemic route<sup>[7]</sup>. In human study,

Dexmedetomidine has also shown to prolong the duration of the block and post-operative analgesia when added to local anesthetic in various regional blocks<sup>[8,9]</sup>. Adding Dexmedetomidine to local anaesthetics during peripheral nerve blockade<sup>[10]</sup> and regional anaesthesia<sup>[11]</sup> procedures may also prove efficacious for the surgical patients. Our present study was designed to test the hypothesis that Dexmedetomidine when added as an adjuvant to Ropivacaine in supraclavicular brachial plexus block hasten the onset and increase the duration of sensory and motor block, duration of analgesia and improve quality of block.

### **Materials and Methods**

After obtaining Institutional Ethical Committee approval and written informed consent from the close relatives of the patients, 80 patients aged between 20 and 55 years with ASA grade 1 or 2 posted for elective forearm and hand surgery were included in the study. The study patients were randomly divided into 2 groups with 40 patients in each group. Group R: 0.50% ropivacaine (30 cc) + 0.5 ml normal saline and Group RD: 0.50% ropivacaine (30 cc) + dexmedetomidine 50  $\mu$ g.

#### **Inclusion Criteria:**

Normal adult patients of either sex, without any comorbidity, admitted for elective upper limb orthopedic surgeries.

1. Patient age: 20-55 years
2. ASA grade: 1 or 2
3. Weight: 50-70 kg
4. Duration of surgery: 2 h.

#### **Exclusion Criteria:**

1. Infection at site of block
2. H/O any previous reaction to the local anesthetic
3. Patients with injury to any of nerves of the upper limb
4. Patient with hemorrhagic disorder
5. Patient below 20 or above 55 years

6. Pregnancy
7. Patient with a neurological disorder
8. Patients with alcohol abuse
9. H/O underlying cardiovascular, psychiatric disease, renal, or hepatic disease.

Pre-anaesthetic assessment was done one day before surgery. All patients were kept electively nil per oral 6-8 h before surgery, and before operation patients were explained about the procedure and a written informed consent taken. Intravenous line secured. Standard monitors such as electrocardiogram, pulse oximeter, blood pressure cuff were applied, and patient's baseline parameter such as pulse, blood pressure, respiratory rate, and SPO2 was recorded. All patients were premedicated with (on operation table): • Injection glycopyrrolate 0.2 mg iv • Injection midazolam 1 mg iv.

For performing brachial plexus blockade through supraclavicular approach, the patients were placed in the dorsal recumbent position with the head turned away from the site of brachial block. Under all aseptic and antiseptic precautions midclavicular point, and subclavian artery pulsation were identified. About 1 cm above the midclavicular point just lateral to subclavian artery pulsation, a 23×11/2" G needle was introduced and directed caudal, downward, and medially toward the first rib until paraesthesia along radial and ulnar distribution or motor response were elicited. On negative aspiration for blood, a total volume of 30.5 ml solution was injected slowly as per allotment of the group and drug. Before every incremental dose negative aspiration for blood was performed to avoid any intravascular injection. The anaesthesiologist performing supraclavicular block was unaware of the constituent of the drug and allotment of the group and similarly resident doctors keeping records of different parameters were also unaware of group allotment. Thus, blinding was properly maintained.

Sensory and motor blockade were assessed every 2 min after completion of injection until 30 min and then every 30 min after the end of surgery until first 12 h, thereafter hourly until the block had completely worn off. Sensory blockade of each nerve was assessed by pinprick. Onset time of motor blockade was defined as the time interval between the end of local anesthetic injection and paresis in all of the nerve distributions. The duration of sensory block was defined as the time interval between the onset of sensory block and the first post-operative pain. The duration of motor block was defined as the time interval between the onset of motor block and complete recovery of motor functions. After 30 min, if the block was considered to be adequate, surgery was allowed. . If the block was considered to be inadequate for surgery, the patient was given general anesthesia .Vitals were recorded before and after the procedure, at 5 min, and there after every 10 min till the end of the procedure and postoperatively at every 1 h till 7 h. Patients were monitored for nausea, vomiting, hypersensitivity reaction, any sign of cardiovascular or central nervous system toxicity, evidence of pneumothorax, hematoma, and post block neuropathy during the study. In post-operative period, when the patient complained of pain at the operative site (visual analog scale  $\geq 4$ ), injection diclofenac sodium 1.5 mg/kg intravenously and the time for rescue analgesia noted. Raw data were entered into a Microsoft Excel spreadsheet and analyzed using standard statistical software SPSS<sup>®</sup> statistical package version 18.0. Categorical variables were analyzed using the Pearson's Chi-square test. Normally, distributed continuous variables were analyzed using the independent sample *t*-test and  $P < 0.05$  was considered as statistically significant.

**Results And Analysis:** We recruited 40 subjects per group. There were no dropouts. However, excluding

subjects who failed blocks, 40 patients in the dexmedetomidine group (RD) and 40 in the normal saline group (R) were eligible for effectiveness analysis.

The age, sex distribution, body weight and duration of surgery in the two groups were found to be comparable [Table 1]. Onset of both sensory and motor block was earlier in RD group than group R [Table 2], and they were clinically significant ( $P > 0.05$ ). Whereas, Table 3, shows that sensory and motor block durations are significantly greater in the group receiving dexmedetomidine (RD) ( $P < 0.05$ ) than group R.

**Table 1:**

Comparison of demographic data between the two study groups

Parameter	Group RD	Group R	P value
Age(years)	30.3± 8.68	30.9± 9.82	0.772
Body weight(kg)	52.57± 5.32	51.98± 7.68	0.690
Sex(male/female) %	40:60	45:55	
Surgery duration(min)	80.56±19.54	78.72±22.98	0.74

**Table 2:**

Comparison of complete onset time of sensory and motor block between two study groups

Parameter	Group RD	Group R	P value
Onset of complete sensory block(min)	16.72± 4.76	19.89± 7.86	0.032
Onset of complete motor block(min)	20.68± 2.85	22.46± 3.92	0.022

**Table 3:**

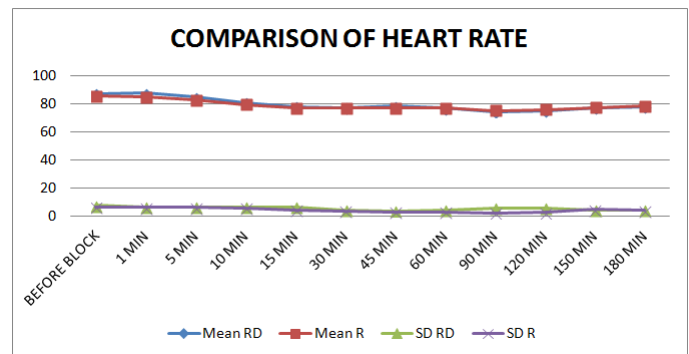
Comparison of duration of sensory (analgesia) and motor block between two study groups

Parameter	Group RD	Group R	P value
Duration of sensory blockade(min) [Analgesia]	806.72± 48.76	639.89± 78.86	0.000
Duration of motor blockade(min)	636.95± 132.85	515.67± 173.92 min	0.000

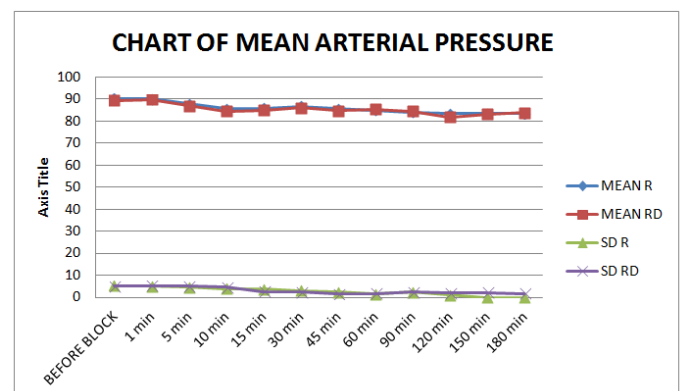
**Table 4:**

Comparison of side effects

Parameters	Group RD	Group R	P value
Vomiting	2	4	0.204
Haematoma	2	3	0.125
Bradycardia	4	1	0.344



**Figure 1: Comparison of Heart Rate**



**Figure 2: Comparison of Mean Arterial Pressure**

**Discussion**

Supraclavicular blocks are performed at the level of the brachial plexus trunks. Here, almost the entire sensory, motor and sympathetic innervations of the upper extremity are carried in just three nerve structures (trunks), confined to a very small surface area. Consequently, typical features of this block include rapid onset, predictable and dense anaesthesia along with its high success rate<sup>[12]</sup>. Local anaesthetics alone for supraclavicular brachial plexus block provide good operative conditions but have a shorter duration of postoperative analgesia. Hence various drugs such as opioids<sup>[3]</sup>, clonidine<sup>[4]</sup>, neostigmine, dexamethasone<sup>[5]</sup>, magnesium<sup>[13]</sup> etc., were used as adjuvant with local anaesthetics in brachial plexus block to achieve quick, dense and prolonged block, but the results are either inconclusive or associated with side-effects.

Dexmedetomidine; a highly selective,  $\alpha_2$ -adrenergic agonist; has analgesic, sedative, anaesthetic sparing effects when used in systemic route<sup>[7]</sup>.<sup>[8]</sup> Use of dexmedetomidine as an adjuvant mixed with local anaesthetics has been performed with neuraxial anaesthesia in both adult and pediatric patients<sup>[14,15]</sup>. Mixing dexmedetomidine as adjuvant with local anaesthetics during peripheral nerve and nerve plexus blockade has recently been practiced by anaesthesiologists<sup>[8,9]</sup>.

In this prospective, randomized, and double-blinded trial, we had compared the effect of 0.5 ml of dexmedetomidine and placebo as an adjuvant to 30 ml 0.50% ropivacaine in supraclavicular brachial plexus block, on the onset time and duration of sensory and motor block as well as on the post-operative rescue analgesic (injection diclofenac sodium) requirement.

The demographic profile, between two groups, which was statistically insignificant ( $P > 0.05$ ) of our patients was quite similar with other research investigations. A study on the role of dexmedetomidine for post-operative

analgesia was conducted by Gupta *et al.* in a total of 100 patients yielded similar results<sup>[16]</sup>.

The onset time of sensory block (16.72 $\pm$  4.76 min in RD group vs. 19.89 $\pm$  7.86 min in R group) was significantly longer in the dexmedetomidine group than in the control group ( $P < 0.001$ ) [Table 2]. These findings correlate with the Ammar and Mahmoud<sup>[11]</sup>, Kaygusuz *et al.*<sup>[17]</sup>, Khemka V, Jadeja PD.<sup>[21]</sup> in their studies, found significantly earlier onset of sensory block in the RD group than in the group R. The onset time of motor block (20.68 $\pm$  2.85 min in RD group vs. 22.46 $\pm$  3.92 min in group R) was also significantly longer in the dexmedetomidine group than in the control group ( $P < 0.05$ ) [Table 2]. Ammar and Mahmoud<sup>[11]</sup>, Gandhi *et al.*<sup>[18]</sup>, Das A, Majumdar S, Halder S, et al.<sup>[20]</sup>, Khemka V, Jadeja PD.<sup>[21]</sup> in their study found that motor block onset was hastened by the use of dexmedetomidine adjuvant in brachial plexus block with bupivacaine.

In our study, the duration of sensory block (806.72 $\pm$  48.76 min in group RD vs. 639.89 $\pm$  78.86 min in group R) was significantly longer in the dexmedetomidine group than in the control group ( $P < 0.001$ ). The duration of motor block (636.95 $\pm$  132.85 min in RD group vs. 515.67 $\pm$  173.92 min in R group) was also significantly longer in the dexmedetomidine group than in the control group ( $P < 0.001$ ). These findings lend support to the observations of various earlier studies by Ammar and Mahmoud<sup>[11]</sup>, Esmooglu *et al.*<sup>[8]</sup>, Marhofer *et al.*<sup>[19]</sup>, Das A, Majumdar S, Halder S, et al.<sup>[20]</sup>, Khemka V, Jadeja PD.<sup>[21]</sup>

In group RD, bradycardia was observed in four patients and all of these patients were managed with 0.5ml atropine. There was one episode of bradycardia in group R. Side-effects-including vomiting, Haematoma though noted in both groups, but the difference was not statistically significant ( $P > 0.05$ ). Esmooglu *et al.*<sup>[8]</sup> also found significant bradycardia in dexmedetomidine plus

levobupivacaine group than levobupivacaine alone. However, they found significant hypotension with dexmedetomidine group, which was absent in our study.

We do conclude that addition of 50 mcg dexmedetomidine to ropivacaine 0.50% solution in supraclavicular brachial plexus block prolongs the duration of sensory and motor blockade reduces the requirement of rescue analgesic in the post-operative period, but has no appreciable effect on the onset time of sensory and motor blockade.

**Source of Support:** Nil

**Conflict of Interest:** None.

### References

1. Bruce BG, Green A, Blaine TA, Wesner LV. Brachial plexus blocks for upper extremity orthopaedic surgery. *J Am Acad Orthop Surg.* 2012;20:38–47.
2. Vainionpää VA, Haavisto ET, Huha TM, Korpi KJ, Nuutinen LS, Hollmén AI, et al. A clinical and pharmacokinetic comparison of ropivacaine and bupivacaine in axillary plexus block. *Anesth Analg.* 1995;81:534–8.
3. Bazin JE, Massoni C, Groslier D, Fenies V, Bittar M, Schoeffler P. Brachial plexus block: Effect of the addition of sufentanil to local anesthetic mixture on postoperative analgesia duration. *Ann Fr Anesth Reanim.* 1997;16:9–13
4. Kohli S, Kaur M, Sahoo S, Vajifdar H, Kohli P. Brachial plexus block: Comparison of two different doses of clonidine added to bupivacaine. *J Anaesthesiol Clin Pharmacol.* 2013;29:491–5
5. Yadav RK, Sah BP, Kumar P, Singh SN. Effectiveness of addition of neostigmine or dexamethasone to local anaesthetic in providing perioperative analgesia for brachial plexus block: A prospective, randomized, double blinded, controlled study. *Kathmandu Univ Med J (KUMJ)* 2008;6:302–9.
6. Gerlach AT, Dasta JF. Dexmedetomidine: An updated review. *Ann Pharmacother.* 2007;41:245–52.
7. Huang R, Hertz L. Receptor subtype and dose dependence of dexmedetomidine-induced accumulation of [14C] glutamine in astrocytes suggests glial involvement in its hypnotic-sedative and anesthetic-sparing effects. *Brain Res.* 2000;873:297–301.
8. Esmoğlu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. *Anesth Analg.* 2010;111:1548–51.
9. Obayah GM, Refaie A, Aboushanab O, Ibraheem N, Abdelazees M. Addition of dexmedetomidine to bupivacaine for greater palatine nerve block prolongs postoperative analgesia after cleft palate repair. *Eur J Anaesthesiol.* 2010;27:280–4.
10. Kettner SC. Dexmedetomidine as adjuvant for peripheral nerve blocks. *Br J Anaesth.* 2013;111:123.
11. Ammar AS, Mahmoud KM. Ultrasound-guided single injection infraclavicular brachial plexus block using bupivacaine alone or combined with dexmedetomidine for pain control in upper limb surgery: A prospective randomized controlled trial. *Saudi J Anaesth.* 2012;6:109–14.
12. Singh S, Aggarwal A. A randomized controlled double-blinded prospective study of the efficacy of clonidine added to bupivacaine as compared with bupivacaine alone used in supraclavicular brachial plexus block for upper limb surgeries. *Indian J Anaesth.* 2010;54:552–7.
13. Dogru K, Yildirim D, Ulgey A, Aksu R, Bicer C, Boyaci A. Adding magnesium to levobupivacaine for

- axillary brachial plexus block in arteriovenous fistule surgery. *Bratisl Lek Listy*. 2012;113:607–9.
14. Al-Ghanem SM, Massad IM, Al-Mustafa MM, Al-Zaben KR, Qudaisat IY, Qatawneh AM, et al. Effect of adding dexmedetomidine versus fentanyl to intrathecal bupivacaine on spinal block characteristics in gynaecological procedures: A double blind controlled study. *Am J Appl Sci*. 2009;6:882–7.
15. El-Hennawy AM, Abd-Elwahab AM, Abd-Elmaksoud AM, El-Ozairy HS, Boulis SR. Addition of clonidine or dexmedetomidine to bupivacaine prolongs caudal analgesia in children. *Br J Anaesth*. 2009;103:268–74.
16. Gupta R, Bogra J, Verma R, Kohli M, Kushwaha JK, Kumar S. Dexmedetomidine as an intrathecal adjuvant for postoperative analgesia. *Indian J Anaesth*. 2011;55:347–51.
17. Kaygusuz K, Ozdemir I, Duger C, GURSOY S, Ozturk H, Kayacan U, et al. Effects of adding dexmedetomidine to levobupivacaine in axillary brachial plexus block. *Curr Ther Res*. 2012;73:103–11.
18. Gandhi R, Shah A, Patel I. Use of dexmedetomidine along with bupivacaine for brachial plexus block. *Natl J Med Res*. 2012;2:67–9
19. Marhofer D, Kettner SC, Marhofer P, Pils S, Weber M, Zeitlinger M. Dexmedetomidine as an adjuvant to ropivacaine prolongs peripheral nerve block: A volunteer study. *Br J Anaesth*. 2013;110:438–42
20. Das A, Majumdar S, Halder S, et al. Effect of dexmedetomidine as adjuvant in ropivacaine-induced supraclavicular brachial plexus block: A prospective, double-blinded and randomized controlled study. *Saudi Journal of Anaesthesia*. 2014;8(Suppl 1):S72-S77. doi:10.4103/1658-354X.144082.
21. Khemka V, Jadeja PD. Comparative Study of Ropivacaine with Dexmedetomidine versus Ropivacaine Alone in Supraclavicular Brachial Plexus Block for Upper Limb Surgery. *Int J Sci Stud* 2017;5(6):74-80.