



## COMPARATIVE EVALUATION OF PERINEURAL AND INTRAVENOUS DEXMEDETOMIDINE AS AN ADJUNCT TO ROPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERIES

**Dr Neha D. Munde** MBBS, PG Student, Resident, Dept. of Anaesthesiology, GMCH Aurangabad

**Dr Rajashri Sonwane** MBBS, MD Anaesthesiology, Professor, CVTS, Dept. of Anaesthesiology GMCH Aurangabad

**ABSTRACT** **Background and Aims:** Supraclavicular block is frequently used to provide good anaesthesia and post-operative analgesia for upper limb surgery. The aim is to compare the quality of block, its onset & duration with perineural and intravenous dexmedetomidine when used as an adjuvant to ropivacaine in supraclavicular brachial plexus block. **Materials And Methodology:** This prospective, randomized, comparative and double-blind study included total 60 patients of either sex with age between 18 to 60 years posted for upper limb surgery, randomly allocated into 2 groups of 30 each. In Group A: 30ml of 0.5% inj. Ropivacaine + 1cc of Inj. Dexmedetomidine 1mcg/kg will be given perineurally and In Group B: 30ml of 0.5% inj. Ropivacaine + 1mcg/kg of Inj. Dexmedetomidine diluted with 10 cc NS will be given IV consecutively over 10mins. Quality, onset, duration of sensory and motor block, postoperative analgesia, vitals, presence of any side effects, Ramsay sedation score and Visual analogue scale score was assessed. **Results:** The quality of surgical anaesthesia is excellent in 100% patients of both groups. Average time of onset of sensory block (minutes) was non significantly lower in Group A (16.07±2.27) compared to Group B (18.17±2.45) (p=0.12). The duration of sensory block was significantly higher in Group A (712.33±50.97) compared to Group B (537.33±28.76) (P<0.0001). Average time of onset of motor block was comparable between the groups. (Group A 21.33±3.46 Vs Group B 23.17±2.78, p=0.8). The duration of motor block was significantly higher in Group A (656±50.74) compared to Group B (492.33±30.36) with P <0.0001. **Conclusion:** Dexmedetomidine given as an adjunct provides excellent quality of surgical anaesthesia in both perineural and intravenous group, longer duration of sensory and motor block, longer duration of postoperative analgesia in perineural group and sedation was comparable without significant hemodynamic changes and side effects in both groups.

**KEYWORDS :** Ropivacaine, Dexmedetomidine, Supraclavicular brachial plexus block.

### INTRODUCTION

Upper limb surgeries are more commonly performed for orthopaedic trauma. These surgeries can be performed under general anaesthesia or regional anaesthesia of upper limb. Regional anaesthesia of upper limb is advantageous over general anaesthesia. For upper limb surgeries brachial plexus block by interscalene, supraclavicular, infraclavicular and axillary approach can be given depending on site of surgery on upper limb. Surgeries from midhumerus to hand can be safely performed with supraclavicular block<sup>(1)</sup>. Supraclavicular block is more safer than interscalene, which is associated with diaphragmatic paralysis<sup>(2)</sup>.

Ropivacaine is an s-isomer of bupivacaine with less cardiotoxicity and neurotoxicity compared to bupivacaine and levobupivacaine<sup>(3)</sup>. Prolonging postoperative analgesia using various adjuvants with local anaesthesia is now-a-days commonly used.

Dexmedetomidine is a  $\alpha_2$  agonist having anaesthetic sparing, analgesic and sedative actions and used in general anaesthesia and regional anaesthesia<sup>(4,5)</sup>. Metaanalysis on use of perineural dexmedetomidine has shown efficacy in early onset of sensory and motor block, good quality of block and prolong duration of post operative analgesia with drawback of sedation, hypotension and prolong motor block<sup>(6,7)</sup>.

While one study shows increased duration of post operative analgesia with intravenous route of dexmedetomidine as adjuvant to brachial plexus block<sup>(8)</sup>.

Comparison between perineural and intravenous dexmedetomidine with local anaesthetic in peripheral block has shown beneficial effects with perineural over intravenous dexmedetomidine<sup>(9,10,11)</sup>. But other studies found comparable results with perineural and intravenous dexmedetomidine<sup>(12,13,14)</sup> but one study found intravenous route is more effective<sup>(15)</sup>.

With these background, the following study was planned to find out the efficacy and safety of perineural versus intravenous dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block for upper limb surgeries.

### MATERIAL AND METHODS

Our prospective, randomized, comparative and double-blind study was conducted in tertiary care hospital over a period of 2 years (November 2020 to October 2022). Inclusion criteria includes Patients of either gender, age 18 to 60 years, ASA grade I and II & Weight 50 to 65 Kg posted for upper limb surgery. Those patients are excluded who

refused to participate in the study, had uncontrolled systemic, prior history of Hepatic, renal, cardiac, CNS, Respiratory insufficiency, had allergy to study drugs, some Coagulation defects, Pregnant or breastfeeding mother & ASA Grade III and IV.

### Selection Of Participants

After obtaining Institutional Ethical Committee approval, Sample size was calculated by considering 20% increase in duration of analgesia as clinical relevant, assuming an error of 0.05 and power of study to be 80%. Sample size was calculated to 52, for this calculation cialc.com sample size calculator was used<sup>(16,17)</sup>. Total 60 patients were included. The purpose of study, entire procedure and effect of drugs being used were explained in detail to participants. Informed consent obtained.

Patients were randomly enrolled by Systematic Randomization Technique into 2 groups (30 in each group). Randomization done by computer generated random number tables into 2 groups –A & B. Double Blinding is done by blinding patient and blinding anesthetist who give drug and record data. Opaque envelopes used for concealment of groups. Drugs prepared by the anesthetist who do not take part in study further. Data then analysed by principle investigator.

### Detail Procedure Of Study

After arrival of patient in OT, NBM status confirmed, monitoring equipment will be applied. 1.RL at 10 to 15ml/kg started. Patient will be kept supine with head turned to contralateral side and supraclavicular block given under guidance of peripheral nerve stimulator (NSML 100). The current started at 1mA and gradually decrease till distal response in the form of paraesthesia will be obtained at 0.5 mA. After that according to group, drug will be given.

In Group A: 30ml of 0.5% inj. Ropivacaine + 1cc of Inj. Dexmedetomidine 1mcg/kg will be given perineurally and 10cc of NS given IV consecutively over 10 mins.

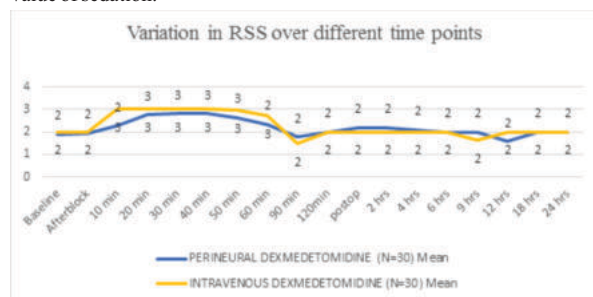
In Group B: 30ml of 0.5% inj. Ropivacaine + 1cc of NS given and 1mcg/kg of Inj.

Dexmedetomidine diluted with 10 cc NS will be given IV consecutively over 10 mins.

Intraoperatively and post operatively Heart Rate, Systolic BP, Diastolic BP, RR, SpO<sub>2</sub>, ECG will be monitored immediately before giving block and after giving block and then every 10 minutes till end of surgical procedure and postoperatively every 15 minutes in recovery room and at 2hr, 4hr, 8hr till 24 hrs patient will be observed



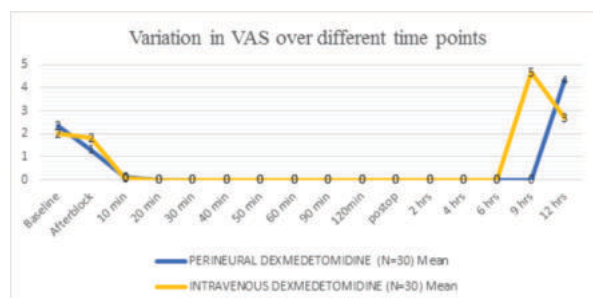
after giving block in intravenous group, afterwards sedation in both groups was comparable without having statistically different mean value of sedation.



**Figure No. 4 : Variation In Rss Over Different Time Points**

In our study Average duration of post operative analgesia in group A (712±51) was significantly higher compared to Group B (537±28) (P<0.0001).

Duration of analgesia is determined from VAS. At 9 hrs P <0.001, suggesting significant difference of duration of post operative analgesia between both groups. Group A shows VAS >4 above 650min whereas Group B shows VAS >4 above 500min.



**Figure No. 5 : Variation In Vas Over Different Time Points**

#### Perioperative Side Effects And Complications

In our study two patients had bradycardia, one from each group which does not require any intervention. No other statistically significant side effects or complications noted in both groups.

#### DISCUSSION

Peripheral nerve blocks are commonly used nowadays for upper limb surgeries as an alternative to general anaesthesia as it provides ideal operating conditions with muscle relaxation, stable intra operative haemodynamic, excellent pain control, post op analgesia, less financial burden, early recovery & reduced side effects.

However the advantages can be short lived & limited by the relatively brief duration of currently available local anaesthetics, potentially resulting in block resolution before the period of worst post-operative pain. To overcome this adjuvants have been tried with local anaesthetics to prolong the intraoperative anaesthesia & postop analgesia.  $\alpha_2$  adrenergic agonist are proved to prolong the effects. We decided to compare dexmedetomidine given by two different routes i.e. perineurally and intravenous. These two groups for their effect as adjuvant to ropivacaine in supraclavicular block for upper limb surgeries.

Various studies have done and found out that ropivacaine has similar efficacy as bupivacaine in Peripheral nerve blocks with least side effects.

Gaurav Kuthiala et.al concluded that efficacy and effects of ropivacaine is similar to that of bupivacaine and its congener levobupivacaine for peripheral nerve blocks<sup>(3)</sup>. Also Stephen M. Klein et.al concluded that increasing the concentration of ropivacaine from 0.5% to 0.75% failed to improve onset or duration effects of block<sup>(19)</sup>. Thus with all these advantages over bupivacaine we decided to use 30 ml Ropivacaine 0.5 % (150 mg) for patients above 50kg considering maximum dose of 3mg/kg<sup>(20)</sup>.

Dexmedetomidine is a highly selective  $\alpha_2$  adrenergic receptors agonist

having 8 times more affinity to  $\alpha_2$  receptors. Its action on the peripheral nervous system and effects as adjuvant has been proved in many studies. The following study was planned to find out the efficacy and safety of perineural versus intravenous dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block for upper limb surgeries.

We chose a dosage of Dexmedetomidine 1µg/kg as an adjuvants to ropivacaine given perineurally and by intravenous route<sup>(21)</sup>. The patients will be divided into two groups and both groups will receive equal volume of drug as mentioned above.

#### Quality Of Anaesthesia

In the study done by Ahtsham U. Niazi, Darrell J. Ogilvie-Harris, Stephanie Oldfield, Rajesh Patel, Justin Oh, Richard Brull<sup>(12)</sup> to define and compare the efficacy of perineural and IV dexmedetomidine in prolonging the analgesic duration of single-injection interscalene brachial plexus block (ISB) for outpatient shoulder surgery. Both perineural and IV dexmedetomidine can effectively prolong the ISB analgesic duration and reduce the opioid consumption without prolonging motor blockade. This finding corroborates with our study.

In our study both perineural and intravenous group shows excellent quality of block that does not requires any supplemental analgesic or sedation and reduces postoperative requirement of analgesics.

#### Onset of Sensory and Motor Block

In the study done by Shashikala TK, Kavya Madhyastha<sup>(22)</sup>, The sensory onset was earlier in perineural Group (4.73 ±1.14 min) compared to intravenous Group (5.00 ± 0.64 min), but this was not statistically significant with p > 0.05. This finding corroborates with our study.

#### Duration Of Sensory And Motor Block

In the study done by Shashikala TK, Kavya Madhyastha<sup>(22)</sup>, the time for complete sensory blockade and motor blockade was earlier in perineural Group (10.13 ± 1.28 min and 14.20 ± 1.44 min) compared to intravenous Group (14.43 ± 0.90 min and 17.03 ± 1.03 min) and it was statistically highly significant (p <0.001). These findings corroborates with our study.

#### Duration Of Analgesia

In the study done by Shashikala TK, Kavya Madhyastha<sup>(22)</sup> total duration of analgesia was also significantly prolonged in perineural Group (701.83 ± 44.92 min) compared to intravenous Group (405.16 ± 30.86 min)[p < 0.001].

Also in the study done by Dr. Deba Gopal Pathak, Dr. Dipanjali Nath<sup>(20)</sup> the duration of analgesia was prolonged in Group B (Dexmedetomidine group) having a mean value of (830.675±84.32) mins in comparison to Group A (Ropivacaine alone group) having a mean value of (330.1±29.82) mins and statistically high significant p <0.001. These results are similar to our study.

In our study Average duration of post operative analgesia in group A (712±51) was significantly higher compared to Group B (537±28) (P<0.0001).

#### Ramsay Sedation Score

In the study done by Fahad Khan, V. P. Singh<sup>(14)</sup>, mean level of sedation in intravenous group when compared to perineural group at different time intervals showed that in intravenous dexmedetomidine group, sedation started at 10 min whereas in perineural dexmedetomidine group it started at 20 mins. The level of sedation had highly significant value till 30 mins (<0.001). At onset of sedation the value of mean level of sedation was 3.55±0.78 and 1.93±0.25 in intravenous and perineural groups respectively which shows that patients in intravenous dexmedetomidine group were moderately sedated whereas that in perineural dexmedetomidine group were only slightly sedated. This finding corroborates with our study.

In our study, the level of sedation has highly significant value at 10min after giving block in intravenous group, afterwards sedation in both groups was comparable without having statistically different mean value of sedation.

#### Hemodynamic Variation

In the study done by Fahad Khan, V. P. Singh<sup>(14)</sup>, the intravenous group took longer time for heart rate to get stabilized 40mins (56.87±3.267



bpm) as compared to perineural group 30mins (58.21±2.112 bpm). The intravenous group reported lower SBP, DBP and MBP as compared to perineural group but none of the groups required any intervention. This finding is similar to our study.

adjunct to 0.5% ropivacaine for supraclavicular brachial plexus block. *Anaesthesia, Pain & Intensive Care*, 413-9.

In our study, the intravenous group reported lower SBP, DBP as compared to perineural group, at different time points. Fall in SBP was significant at 20min, 30min (P-0.002, 0.001) but none of the group reported a fall which required any intervention in any group.

### Side Effects And Complications

In our study two patients had bradycardia, one from each group which does not required any intervention. No other statistically significant side effects or complications noted in both groups.

### CONCLUSION

To conclude our study, dexmedetomidine given as an adjunct to ropivacaine in supraclavicular brachial plexus block for upper limb surgeries provides excellent quality of surgical anaesthesia in both perineural as well as intravenous group and longer duration of sensory and motor block and longer duration of postoperative analgesia in perineural route compared to intravenous route of dexmedetomidine and sedation was comparable in both route without significant hemodynamic changes and side effects in both groups.

### REFERENCES

- 1) D'Souza RS, Johnson RL.(2022). Supraclavicular Block. StatPearls [Internet].
- 2) Auyong DB, Hanson NA, Joseph RS, Schmidt BE, Snee AE, Yuan SC. (2018) Comparison of Anterior Suprascapular, Supraclavicular, and Interscalene Nerve Block Approaches for Major Outpatient Arthroscopic Shoulder Surgery: A Randomized, Double-blind, Noninferiority trial. *Anesthesiology*, 129(1):47-57.
- 3) Kuthiala G, Chaudhary G.(2011). Ropivacaine: A review of its pharmacology and clinical use. *Indian journal of anaesthesia*, 55(2):104.
- 4) González AR.(2019). Dexmedetomidine as an adjuvant to peripheral nerve block. *Rev. de la Soci. Española del Dolor*, 26(2):115-7.
- 5) Sudheesh K, Harsoor SS.(2011). Dexmedetomidine in anaesthesia practice: A wonder drug?. *Indian Journal of Anaesthesia*, 55(4):323.
- 6) Ping Y, Ye Q, Wang W, Ye P, You Z.(2017). Dexmedetomidine as an adjunct to local anaesthetics in brachial plexus block: A meta-analysis of randomised controlled trials. *Medicine*, 96(4): e5846.
- 7) Vorobeichik L, Brull R, Abdallah FW.(2017). Evidence basis for using perineural dexmedetomidine to enhance the quality of brachial plexus nerve blocks: a systematic review and meta-analysis of randomized controlled trials. *BJA: British Journal of Anaesthesia*, 118(2):167-81.
- 8) Kang R, Jeong JS, Yoo JC, Lee JH, Choi SJ, Gwak MS, Hahm TS, Huh J, Ko JS.(2018). Effective dose of intravenous dexmedetomidine to prolong the analgesic duration of interscalene brachial plexus block: a single-center, prospective, double-blind, 98 randomized controlled trial. *Regional Anesthesia & Pain Medicine*, 43(5):488-95.
- 9) Sivakumar RK, Panneerselvam S, Cherian A, Rundingwa P, Menon J.(2018). Perineural vs. intravenous dexmedetomidine as an adjunct to bupivacaine in ultrasound guided fascia iliaca compartment block for femur surgeries: A randomised control trial. *Indian journal of anaesthesia*, 62(11):851.
- 10) Somsunder RG, Archana NB, Shivkumar G, Krishna K.(2019). Comparing efficacy of perineural dexmedetomidine with intravenous dexmedetomidine as adjuvant to levobupivacaine in supraclavicular brachial plexus block. *Anesthesia, Essays and Researches*, 13(3):441.
- 11) Mohassab MA, Messbah WE, Amin SM, Fatooh NH.(2020). Comparative study between the effect of perineural versus intravenous dexmedetomidine in ultrasound-guided Supraclavicular brachial plexus block. *Journal of Advances in Medicine and Medical Research*, 32(11):37-45.
- 12) Abdallah FW, Dwyer T, Chan VW, Niazi AU, Ogilvie-Harris DJ, Oldfield S, Patel R, Oh J, Brull R.(2016). IV and perineural dexmedetomidine similarly prolong the duration of analgesia after interscalene brachial plexus block: a randomized, three-arm, triple-masked, placebo-controlled trial. *Anesthesiology*, 124(3):683-95.
- 13) Schnabel A, Reichl SU, Weibel S, Kranke P, Zahn PK, Pogatzki-Zahn EM, Meyer-Frießem CH.(2018). Efficacy and safety of dexmedetomidine in peripheral nerve blocks: a meta-analysis and trial sequential analysis. *European Journal of Anaesthesiology*, 35(10):745-58.
- 14) Khan F, Singh VP.(2018). A comparative study of intravenous versus perineural administration of dexmedetomidine in supraclavicular brachial plexus block using 0.75% ropivacaine by ultrasound guided technique in upper limb surgeries. *Int J Res Med Sci [Internet]*, 6(7):2407-13.99.
- 15) Samar P, Dhawale T A, Pandya S.(2020). Comparative Study of Intravenous Dexmedetomidine Sedation With Perineural Dexmedetomidine on Supraclavicular Approach Brachial Plexus Block in Upper Limb Orthopaedic Surgery. *Cureus*, 12(10): e10768.
- 16) Al-Sulaiti FK, Nader AM, Saad MO, Shaikat A, Parakadavathu R, Elzubair A, Al Badriyeh D, Elewa H, Awaisu A.(2019). Clinical and pharmacokinetic outcomes of peak–trough-based versus trough-based vancomycin therapeutic drug monitoring approaches: a pragmatic randomized controlled trial. *European Journal of Drug Metabolism and Pharmacokinetics*, 44:639-52.
- 17) Rosner B.(2015). *Fundamentals of biostatistics*. Cengage learning.
- 18) Sessler CN, Grap MJ, Ramsay MA.(2008). Evaluating and monitoring analgesia and sedation in the intensive care unit. *Critical Care*, 12(3):S2.
- 19) Klein SM, Greengrass RA, Steele SM, D'Ercole FJ, Speer KP, Gleason DH, DeLong ER, Warner DS.(1998). A comparison of 0.5% bupivacaine, 0.5% ropivacaine, and 0.75% ropivacaine for interscalene brachial plexus block. *Anesthesia & Analgesia*, 87(6):1316-9.
- 20) Dr. Deba Gopal Pathak, Dr. Dipanjali Nath.(2020). A comparative study of ropivacaine Versus ropivacaine with Dexmedetomidine as an adjuvant in Supraclavicular brachial plexus block; *Indian journal of research*, 10(4): 2250–1991.
- 21) Gupta SS, Shinde JP.(2017). Dexmedetomidine as an Adjuvant with Ropivacaine in Supraclavicular Brachial Plexus Block in Upper Limb Surgeries: A Case Control Study. *JMSCR*;5(11).p 30494-30501.
- 22) Shashikala TK, Madhyastha K.(2017). A prospective randomized double blinded study to evaluate the efficacy of dexmedetomidine 50 µg intravenously and perineurally as an