

Evaluation of The Efficacy of Dexmedetomidine And Dexamethasone When Used As Adjuvant To Ropivacaine In Supraclavicular Brachial Plexus Block for Upper Limb Surgeries

Dr Abhilash Dash¹, Dr Rabi Narayan Dhar², Dr Ramakanta Mohanty³, Dr Sidharth Sraban
Routray⁴, Dr Soumyakant Mallick⁵

¹Asst Prof, Department of Anaesthesiology and Critical care IMS and SUM Hospital, Siksha
'O' Anusandhan (Deemed to be University) BHUBANESWAR, ODISHA INDIA, ²Assoc
Prof, Department of Orthopaedics, VIMSAR, Burla, Odisha, India, ³Associate Professor,
Department of Surgery, F. M Medical College, Balasore, Odisha, India. ⁴Assoc Prof, ⁵
Senior resident, Department of Anaesthesiology, SCB Medical College, Cuttack, Odisha,
India

³drsidharth74@gmail.com

Abstract: We have done this trial in order to correlate analgesic dexmedetomidine (DXM) & dexamethasone (DX) efficacy in form of an additive for supraclavicular brachial plexus (SCBP)'s ropivacaine blockage for upper extremity surgery. This is trial in which, 18–65 yrs 70 ASA status type one and two individuals suffering from disease, posted for upper extremity surgery was split randomly within couple of categories. Class DXM got 2 ml of normal saline containing dexmedetomidine (1mcg/kg) with 0.5% ropivacaine (30 ml) and Class DX got 2 ml (8 mg) of dexamethasone with 0.5% ropivacaine (30 ml). SCBP block was performed under ultrasonography (USG). The primary outcome was time of 1st analgesic request and no of analgesic request in 1st 24hrs. Secondary end result of the trial were Motor block & sensory were secondary trial end result onset & time & incidence associated with drug's side effects. Time for request of 1st rescue analgesia was 720.50±67.87min in Class DXM and 591.83±52.25min in Class DX. Total rescue analgesia required within post-operative for 1 day into DXM Class is less in comparison to DX Class. The mean of onset time of motor block & sensory into Class DXM is lesser in comparison to Class DX, which is statistically important. In Class DXM mean of duration of sensory block was 656.50± 50.58min, which was significantly longer than Class DX where duration was 534.10± 62.43min. Mean of motor block duration was 611.83± 45.3min in Class DXM and 470.83± 59.40min in Class DX (p<0.001). Dexmedetomidine provided prolonged relief from suffering after utilizing it in form of an additive to SCBP portion's ropivacaine when compared to dexamethasone.

Keywords: Dexmedetomidine, dexamethasone, ropivacaine, supraclavicular, brachial plexus

1. INTRODUCTION:

Different local blocks in anaesthesia has merits like feeling free from suffering of disease, lower complications, & reduces the presence's extent within both hospital & unit of post-anaesthesia care. USG guided supraclavicular brachial plexus (SCBP) blockade not only produce quality anaesthesia for extremity surgery and post-operative analgesia but

also avoids intravascular injection thereby avoiding complications.[1] A fairly new local anaesthetic that is same in form to bupivacaine is Ropivacaine, while less cardio and neurotoxic compared to bupivacaine. Ropivacaine has properties like delayed on-set & shorter time period associated with action correlated with bupivacaine for which it is less preferred for use during regional anaesthesia.[2] Many drugs have been studied including opioids, glucocorticoid like dexamethasone, alpha-2 receptors agonists like dexmedetomidine & clonidine into supraclavicular system as an anticoagulant to ropivacaine to extend the length of postoperative pain relief but none, found ideal.[3] Adjuvant like dexmedetomidine (DXM) & dexamethasone (DX) had separately revealed for increasing time period of postoperative pain relief after using it as additive with Epidural tenochitlán for obstruction vertebral column. There are also just a few literature reports that explicitly equate potency of DXM & DX through ropivacaine to SCBP block which has also shown conflicting results. So present research aimed for finding DX and DXM's potency in form of ropivacaine's adjunct SCBP section. The trial's primary aim was to find out the time of 1st analgesia request and no of analgesic request required in 1st 24hrs. Our secondary aim was to evaluate motor block & sensory as well as time period & incidence associated with drug's adverse effects.

2. METHODS

The particular method is prospective randomised experiment which is performed at a Medical Center in Odisha within time span of 6 months - from Nov 2019 to April 2020 after compliance of regional Institutional Organization. Each individual suffering from disease has given informed context. 60 ASA status 1 & 2 individuals suffering from disease of ASA status I/II, age 19–67 yrs, organized at upper extremity treatment was incorporated in this trial. Subjects who didn't agree to participate, patients who are obese with short neck, patients with coagulation and neurological abnormalities, or infected portion and patient shaving previous medical history were kept out from the trial.

Preoperative evaluation was performed on the day before surgery. Oral tab alprazolam 0.5 milligram & ranitidine 150 milligram are offered for every individuals suffering from disease at night before the treatment. For assessment of pain all patients were explained about numerical rating scale (NRS).

Using a computer-generated programme, 60 patients were split into couple of classes of 30. (Class DX, Class DXM, total of thirty). To guarantee the list of assignments is hidden, allotted Class is confined in a secured envelope. Class DXM were given 32 ml of 0.5% dexmedetomidine + ropivacaine 1 mcg/kg and Class DX were given 3 ml dexamethasone (8mg) + 32 ml of 0.5% ropivacaine. Operator (not in trial), showed envelope before surgery & started to identify drug.

On arrival to operation theatre the patients were given a peripheral IV canula (18g) on the non operative hand and standard monitors were attached. blood pressure, Pulse rate (PR), saturation of O₂ (SpO₂) & three leads ECG were monitored. All the emergency drugs and equipments for emergency conversion to general anaesthesia were kept ready.

Transportable ultrasound machine with a linear transducer (8–13 MHz) was used for the SCBP block.[4] The patients were made supine, contra lateral side where the head is directed and then hand was adducted. Behind middle third of the clavicle, transducer was put in the supraclavicular fossa to visualise the brachial plexus. 5–6 hypoechoic circles which look like cluster of grapes, was visualised indicating brachial plexus. This is found between anterior and middle scalene muscles, lateral and superior to subclavian artery. The study drug, upon negative injection, was administered to avoid unintended intravenous vein rupture. In different tissue planes, the spread of drug was observed. Correct needle placement was defined by distension of the brachial plexus sheath after injection. Class DXM

received ropivacaine plus dexmedetomidine and ClassDX received ropivacaine plus dexamethasone.

Pinprick method was used to assess the sensory blockade at every minute after injection for that substance. Ulnar & median nerve blocks have been tracked by testing the upper side of the palmar & small finger, respectively. The anterior thumb layer has been utilized to test the peripheral nerve barrier. Sensory-section [5] is assessed in form of;

Grade-0: Normal pin prick sensation

Grade-1: Very low pin prick sensitivity

Grade 2: Absence of sensation.

The occurrence of a spinal anaesthesia was defined as the time period among growth inhibitors & emergence of secure storage of grade 1 across all 3 nerve distribution. Total sensory block has been taken upon a pin-prick as no feeling. Sensory block length was considered as period among no sensation to a pinprick and coming back of normal pin prick sensation. Blockade of Motor is assessed by abducting finger for blockade of ulnar & peripheral nerve. For blockade of median nerve thumb apposition was tested and for blockade of musculocutaneous nerves, Checked elbow flexor muscles & forearm supination. To assess the motor blockade, Lovett rating scale was used. [6] The onset time of engine block were described as the interval among the end of the opioid injecting test & total paralysis. The length of motor blockade has been described as time from complete limb weakness to complete restoration of muscle control.

Post-operative pain is assessed by an operator who was unaware about study drug preparation. Postoperative analgesia was assessed by numeric rating scale (NRS) of 0 - 10 at each hour. [7] Inj. Tramadol 100 milligram is offered IV in form of analgesia relief, when NRS score were >5. Heart rate, blood pressure (SBP, DBP, MAP) and O₂ saturation was monitored preoperative within no seconds (immediately followed by given the opioid), 15 min, 46 min, 60 min, 75 min, 90 min, 105 min, 120 min, 4, 8, 12, 24 hrs.

Time of 1st analgesia request and total dose of analgesic required for 1st 24 hours were noted. Motor block onset & sensory & time period were recorded. An initial pilot study, involving ten patients with 'time needed for 1st analgesic request as the primary end point of the trial was done for sample size calculation. Time to first analgesic request was 664.72 ± 72.2 min in dexmedetomidine Class and 602.45 ± 86.2 min in dexamethasone Class. With power of research ($1 - \beta$) at 81% & α error of 0.05, to determine at least 60 min variation in time needed for rescue analgesic among both Classes, size of sample size computed & found to be 26 in either Class. 30 individuals suffering from disease were taken in every Class to make up for potential drop-out. Demographic data, motor block & sensory the onset & time period are classified & examined utilizing learner's t-test which are not paired & test of Chi-square. $P < 0.001$ is termed to be statistically important. Analytical data is prepared utilizing SPSS software (IBM)

3. RESULTS

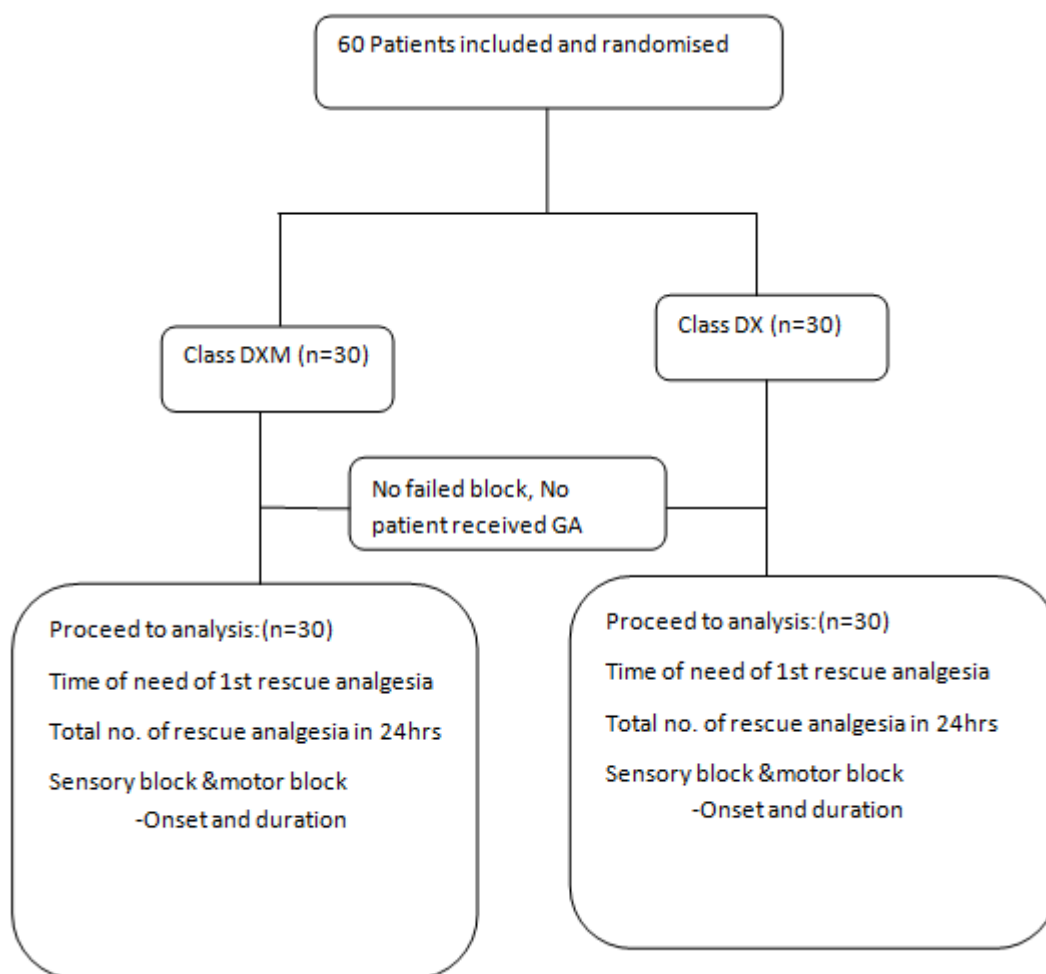


Fig1: Diagram showing the patients registered in the study and analysis.

SCBP section is good within registered individuals suffering from disease, & all those finished trial.(fig 1). Table 1 shows the demographic variables in which there was similarity with respect to gender, age, weight, ASA status & time period required for treatment among both Classes.

Table 1: Demographic variables

Factors	Class DXM	Class DX	<i>P</i> value
Age (Year)	39.83 ± 12.37	39.46 ± 11.3	0.905
Gender (M/F)	17/13	19/11	0.598
Weight (Kg)	56.03 ± 8.64	55.9 ± 8.47	0.952
ASA status (I/II)	21/9	19/11	0.584

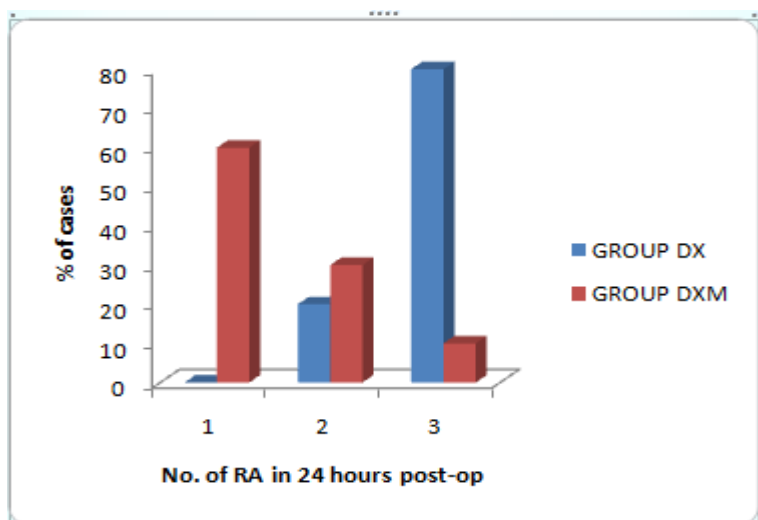
Duration of surgery(min)	114.4 ± 9.5	120.2 ± 4.2	0.381
--------------------------	-------------	-------------	-------

Table 2: SCBP block characteristics

Variables	Class DXM	Class DX	P Value
Sensory block onset(min)	11.41 ± 1.25	15.05 ± 1.15	<0.001
Motor block onset(min)	13.91 ± 1.04	17.78 ± 1.05	<0.001
Sensory block duration(min)	656.50± 50.58	534.10± 62.43	<0.001
Motor block duration(min)	611.83± 45.3	470.83± 59.40	<0.001
Request for first rescue analgesia(min)	720.50±67.87	591.83±52.25	<0.001

The request for first rescue analgesia was delayed (720.50±67.87min) in ClassDXM compared to Class DX(591.83±52.25min) which was statistically remarkable. (p<0.001) (Table 2) Sensory block onset was earlier in Class DXM(11.41 ± 1.25min) as compared to Class DX(15.05 ± 1.15min) which was statistically remarkable. (p<0.001) Motor block onset is earlier in Class DXM(13.91 ± 1.04min) as compared to Class DX(17.78 ± 1.05min) which was statistically remarkable. (p<0.001) Sensory block duration were longer(656.50± 50.58min) in DXMClass than DX Class(534.10± 62.43min) which was statistically remarkable.(p<0.001) Motor block duration were longer(611.83 ± 45.30min) in DXM Class than DX Class(470.83± 59.40min) which is generally remarkable.(p<0.001) (Table-2) Fig no 2 depicts that in Class DXM, only 1 rescue analgesic was given in 60% of patients and 2 rescue analgesic was given in 30% of patients where as 3 rescue analgesic doses was given in only 10% of patients in 1st day. In Class DX, 80% of patients received 3 rescue analgesia and 20% of patients received 2 rescue analgesia doses in 1st day. That disparity is extremely statistically important in both groups (p<0.001). No harmful consequences also at the time of intra & preoperative phases.

Fig 2: No of rescue analgesia in 1st 24 hours



4. DISCUSSION

Many adjuvant like clonidine, tramadol, dexmedetomidine and neostigmine added to local anaesthetics have been studied in SCBP block, but each drug has its own adverse effects.[8] Dexamethasone, a long-acting glucocorticoid is utilized in form of additive for regional anaesthetic agents in SCBP block. It produces vasoconstriction and slows the absorption of local anaesthetics and thereby increases the duration action.[9] Few studies in literature had opined that dexamethasone when utilized in form of additive with lignocaine & bupivacaine prolonged time period of motor & sensory block in SCBP block.[10] As the search for ideal dose of dexamethasone in SCBP block goes on, there were very few studies in the literature using 8 mg of dexamethasone with ropivacaine in SCBP block. No major adverse effect were recorded in the literature using dexamethasone 8 mg as an additive in SCBP block.[11] Hence, we have used 8 mg of dexamethasone to investigate its effect not only on duration but also on motor & sensory block onset. Pani et al in a trial concluded that dexamethasone when used as additive to levobupivacaine in SCBP block delayed the time of 1st analgesic request. [12] Chinnappa et al in their trial opined that perineural injection of dexmedetomidine with ropivacaine quickens the sensory and motor block onset and prolongs the post-operative relief from suffering in the SCBP block.[13] In a Deliberate, partial meta-analysis, researchers concluded that dexamethasone is a more potent additive than dexmedetomidine in SCBP block which is in disagreement with our study.[14] In our trial we found faster onset of motor block & sensory in Class DXM in comparison to DX Class. Post-operative relief from suffering is remarkably prolonged into DXM Class (720.50±67.87 min), while it was only (591.83±52.25 min) in DX Class (p <0.001). Not a single individual in both Classes had significant hemodynamic complications like hypotension or bradycardia. There were still no harmful symptoms, such as fatigue, vomiting & scratching in our study in either of the Classes. Researchers concluded - dexmedetomidine reduced the onset time associated with motor blockade & sensory in plexus block of axillary brachial in which 40 millilitre of levobupivacaine (0.5%) was used along with a nerve stimulator.[15] Lee et al in his study of axillary brachial plexus block, found that dexmedetomidine 100 mcg & dexamethasone 10 mg and had similar efficacy in increasing the duration of action of ropivacaine. Nonetheless, no medication has major impact upon this start time. This is in contrast to our study.[16] Kaur et al in his trial, revealed that it was similar in both dexmedetomidine Class and dexamethasone Class, but dexmedetomidine Class showed very long time period of sensory-motor section in comparison to dexamethasone Class. They opined that using dexmedetomidine as adjuvant, prolongs time period of motor-sensory block & provides prolonged Anaesthetic preoperative relative to tamoxifen minimal or negligible adverse event which was similar to our study.[17] Researcher in research of 100 patients found - motor-sensory section's time of onset was before with dexmedetomidine Class in comparison to dexamethasone Class. They concluded that both dexamethasone and dexmedetomidine when used as additive with ropivacaine in SCBP block increases the time of relief but dexmedetomidine has quicker motor-sensory section in comparison to dexamethasone which is in agreement with our study.[18] Chaithanya et al observed both early prolonged & onset time period of motor-sensory section into dexmedetomidine Class in comparison with dexamethasone Class. Also intra-operative hemodynamic were similar in two Classes which was similar to our study.[19] Researchers stated - dexamethasone provided larger analgesia which is post-operative and sparing impact of opioid compared to dexmedetomidine in interscalene block which is in contrast to our study findings. This may be due to the fact that dexmedetomidine was used in the dose of 0.5 mcg/kg instead of 1 mcg/kg. [20]

There were certain drawbacks to the report. First, it involved only patients with ASA grades I and II; thus, the research findings could not be extended to patients with higher ASA physical classification ratings. Third, there was no assessment of serum amounts of ropivacaine, dexmedetomidine & dexamethasone; Finally, it could be more important to assess the time period required to stay in the clinic and the long-term effects of pain management & contributed more intensity to analysis. Also we have not studied the incidence of steroid-induced hyperglycaemia. Researchers conclude, nevertheless, that neither of these limitations could disprove the research's primary findings inside the boundaries of their usefulness & extensibility though a bigger sample could have been taken which could have given a clearer picture about the block characteristics.

5. CONCLUSION

Dexmedetomidine when applied as an additive to ropivacaine for upper extremity surgeries under ultrasound guided SCBP block had deferred the time for need of rescuing analgesia's & also decrease its need compared to dexamethasone. It had produced not only quicker onset motor-sensory section but also provided pro-longed pain relief which is post-operative.

REFERENCES

- [1] Soeding PE, Sha S, Royse CE, Marks P, Hoy G, Royse AG. A randomized trial of ultrasound-guided brachial plexus anaesthesia in upper limb surgery. *Anaesth Intensive Care* 2005;33:719–725.
- [2] Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. *Indian J Anaesth* 2011;55:104-10.
- [3] Das A, Majumdar S, Halder S, Chattopadhyay S, Pal S, Kundu R, Mandal SK, Chattopadhyay S. Effect of dexmedetomidine as adjuvant in ropivacaine-induced supraclavicular brachial plexus block: A prospective, double-blinded and randomized controlled study. *Saudi J Anaesth* 2014;8, Suppl S1:72-7
- [4] Kathuria S, Gupta S, Dhawan I. Dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block. *Saudi J Anaesth* 2015;9:148-54
- [5] Golwala M, Swadia V, Dhimar A, Sridahr N. Pain relief by dexamethasone as an adjuvant to local anaesthetics in supraclavicular brachial plexus block. *J Anaesth Clin Pharmacol.* 2009; 25:285-288
- [6] Zhang Y, Wang CS, Shi JH, Sun B, Liu SJ, Li P, Li EY. Perineural administration of dexmedetomidine in combination with ropivacaine prolongs axillary brachial plexus block. *Int J Clin Exp Med.* 2014 Mar 15;7(3):680-5. eCollection 2014.
- [7] Kumar S, Palaria U, Sinha AK, Punera DC, Pandey V. Comparative evaluation of ropivacaine and ropivacaine with dexamethasone in supraclavicular brachial plexus block for postoperative analgesia. *Anesth Essays Res.* 2014 May-Aug;8(2):202-8.
- [8] Kim YJ, Lee GY, Kim DY, Kim CH, Baik HJ, Heo S. Dexamethasone added to levobupivacaine improves postoperative analgesia in ultrasound guided interscalene brachial plexus blockade for arthroscopic shoulder surgery. *Korean J Anesthesiol.* 2012;62(2):130 - 134.
- [9] Biradar PA, Kaimar P, Gopalakrishna K. Effect of dexamethasone added to lidocaine in supraclavicular brachial plexus block: A prospective, randomised, double-blind study. *Indian J Anaesth.* 2013;57(2):180 - 184.
- [10] Choi S, Rodseth R, McCartney CJ. Effects of Dexamethasone as a local anaesthetic adjuvant for brachial plexus block: a systematic review and meta-analysis of randomized trials. *Br J Anaesth.* 2014; 112(3): 427-39.

- [11] De Oliveira GS Jr, Castro Alves LJ, Nader A, Kendall MC, Rahangdale R, McCarthy RJ. Perineural dexamethasone to improve postoperative analgesia with peripheral nerve blocks: a meta-analysis of randomized controlled trials. *Pain Res Treat* 2014; 2014: 179029
- [12] Pani N, Routray SS, Mishra D, Pradhan BK, Mohapatra BP, Swain D. A clinical comparison between 0.5% levobupivacaine and 0.5% levobupivacaine with dexamethasone 8 mg combination in brachial plexus block by the supraclavicular approach. *Indian J Anaesth* 2017; 61:302-7.
- [13] Chinnappa J, Shivanna S, Pujari VS, Anandaswamy TC. Efficacy of dexmedetomidine with ropivacaine in supraclavicular brachial plexus block for upper limb surgeries. *J Anaesthesiol Clin Pharmacol.* 2017; 33(1):81 - 85.
- [14] Albrecht E, Vorobeichik L, Jacot-Guillarmod A, Fournier N, Abdallah F. Dexamethasone Is Superior to Dexmedetomidine as a Perineural Adjunct for Supraclavicular Brachial Plexus Block: Systematic Review and Indirect Meta-analysis. *Anesth Analg.* 2019 Mar; 128(3):543-554.
- [15] Esmoğlu A et al, Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. *Anesth Analg.* 2010 Dec; 111(6):1548-51.
- [16] Lee MJ, Koo DJ, Choi YS, Lee KC, Kim HY. Dexamethasone or Dexmedetomidine as Local Anesthetic Adjuvants for Ultrasound-guided Axillary Brachial Plexus Blocks with Nerve Stimulation. *The Korean Journal of Pain.* 2016; 29(1):29-33.
- [17] Kaur M, Lakhani A, Hashia A. Comparative study between dexamethasone and dexmedetomidine in supraclavicular block. *International Journal of Advances in Medicine.* 2018; 5(1): 57-61.
- [18] Verma N, Ranjan A. A clinical comparison of Dexmedetomidine and Dexamethasone as adjuvant to Ropivacaine in Supraclavicular brachial plexus blocks for upper arm surgeries. *Int. J. Adv. Res. Biol. Sci.* (2016). 3(7): 56-61
- [19] Chaithanya K, Asritha, Reddy N, Sangamithra. A comparative study between 0.375% ropivacaine with 50mcg of dexmedetomidine and 0.375% ropivacaine with 8mg of dexamethasone for ultrasound guided supraclavicular brachial plexus block. *Indian Journal of Clinical Anaesthesia,* 2017; 4(1): 69-73
- [20] Kataria S, Mitra S, Saroa R, Jindal S, Gupta R. Asian Journal of A Randomized Double Blinded Trial Comparing Dexmedetomidine With Dexamethasone as an Adjunct to Ropivacaine in Ultrasound Guided Interscalene Block for Arthroscopic Shoulder Surgery *Anesthesiology* Mar. 2019 ; 57(1): 10-18.