Comparison of Dexmedetomidine Vs Dexamethasone as an Adjuvant to 0.5% Ropivacaine in Ultrasound Guided Supraclavicular Brachial Plexus Block in Upper Limb Orthopaedics Surgeries

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Abstract:

Background

Dexmedetomidine and Dexamethasone demonstrate advantages in extending the duration of local anesthetics' effects. We evaluated the effectiveness of Dexmedetomidine against Dexamethasone as an adjunct to 0.5% ropivacaine in ultrasound-guided Supraclavicular Brachial Plexus Block (SCBP) for upper limb orthopedic procedures.

Methodology:

60 ASA grade I and II patients were assigned to two groups. Group A (n=30): Injection of Ropivacaine 0.5% 30ml with Injection of Dexamethasone (8mg) Group B (n=30): Inj. Ropivacaine 0.5% 30 ml + Inj. Dexmedetomidine (1 µg/kg). The primary and secondary outcomes were to assess the onset and duration of sensory and motor blockage, respectively. Statistical analysis conducted with SPSS software

Results:

The demographic factors were equivalent between the two groups. A statistically significant difference was noted in the onset and duration of sensory and motor block between Group B (inj. Ropivacaine + inj. Dexmedetomidine) and Group A (inj. Ropivacaine + inj. Dexamethasone) ($P<0.05$); Group B exhibited a more rapid onset and an extended duration of sensory and motor

blockade. The VAS score in group B was considerably lower than in group A at the 12-hour mark (p=0.008).

Conclusion:

Dexmedetomidine has a more rapid onset and extends the duration of sensory and motor blockade, while also reducing post-operative analgesic requirements compared to dexamethasone when used as an adjuvant to ropivacaine in supraclavicular brachial plexus block, without any side effects.

Keywords: Dexamethasone; Dexmedetomidine; Ropivacaine; Supraclavicular Brachial Plexus Block.

Introduction

Peripheral nerve blocks play a significant role in contemporary anesthesia management by facilitating optimal operational circumstances and providing superior postoperative analgesia without systemic adverse effects. The brachial plexus block serves as an effective alternative to general anesthesia for upper limb procedures, since it little impacts systemic physiology. Utilizing ultrasonic guiding enhances the precision and safety of the block. 1

The ultrasound-guided supraclavicular brachial plexus block is a recognized technique used in upper limb procedures. This approach allows direct observation of the peripheral nerve, needle tip, and distribution of local anesthetic agents. As a result, it provides superior procedural precision, better block quality, and expedited onset and diminished problems, eventually resulting in abbreviated hospital stays and lower expenses. To prolong the analgesic effects of Supraclavicular brachial plexus (SCBPs) blocks beyond the pharmacological duration of the local anesthetic, techniques include the placement of indwelling perineural catheters for extended infusion or the simultaneous administration of adjuncts such as epinephrine, α2-agonists like clonidine and dexmedetomidine, midazolam, or the corticosteroid dexamethasone. [3]

Dexamethasone has nerve block prolongation properties and is classified as a long-acting glucocorticoid. They also induce analgesia by inhibiting the transmission of nociceptive myelinated C-fibers. Consequently, dexamethasone was chosen as an adjunct to local anaesthetics used in brachial plexus blocks. Dexmedetomidine is a selective α2-receptor agonist used as an adjunct to local anesthetics, since it extends motor blockade by blocking sodium channels and amplifying the efficacy of local anesthetic agents.

Ropivacaine, a novel local anesthetic, does this by suppressing neuronal excitability and conduction via the blockage of neuronal sodium channels. Its limited inhibitory impact on the central nervous system makes it a preferred option for nerve block anesthesia. Moreover, ropivacaine has vasoconstrictive properties, thereby diminishing the systemic absorption of medications. 4

This research aims to assess Dexmedetomidine and Dexamethasone as adjuvants to 0.5% Ropivacaine in ultrasound-guided supraclavicular brachial plexus block for upper limb orthopedic procedures.

Aims and Objectives:

Primary objective was to evaluate the onset of sensory and motor block while the secondary objective was to assess total duration of sensory and motor block on addition of dexmedetomidine and dexamethasone with ropivacaine for ultrasound guided supraclavicular brachial plexus block

Materials & Methods

The research was conducted as a hospital-based prospective clinical trial at the Department of Anaesthesiology, SCB Medical college and Hospital, Cuttack and SJMC, Puri. Patients aged 18 to 60 years, categorized as ASA Class I and II, undergoing upper limb orthopedic surgeries with supraclavicular block, were recruited for the study following approval from the institutional ethics committee and informed consent from the participants. Patients with injection site infections, known allergies to any study medicines, pre-existing systemic illnesses, peripheral neuropathy, a history of seizures, suspected coagulopathy, or those who were reluctant or unable to provide permission were excluded from the trial.
The sample size calculation used a convenience sampling approach and was informed by a prior research conducted by Nidhi Singh et al. [5] The equation for determining the sample size is $n = 2[Z(1-\alpha/2) + Z(1-\beta)]^2 x\sigma^2/d^2$. Taking into account a non-response rate of 10%, the minimum required sample size was 30 each group, totaling 60.

60 patients were randomly allocated to one of two research groups using a computer-generated randomization schedule after pre-anaesthetic assessment and standard procedures.

- Group A (n = 30): Administered Inj. Ropivacaine (0.5%) 30ml and Inj. Dexamethasone (8mg)
- Group B (n = 30): Administered Inj. Ropivacaine (0.5%) 30 ml with Inj. Dexmedetomidine (1 μg/kg)

All hemodynamic variables were monitored before, during, and immediately after the induction at regular intervals. All variations from baseline values were recorded. The patient had upper limb surgery with an ultrasound-guided supraclavicular brachial plexus block. Postoperatively, when the VAS score exceeded 3, both groups received rescue analgesia with intravenous tramadol 50 mg administered slowly and were observed for up to 12 hours throughout the trial. Administer Inj Diclofenac 75 mg in 100 mL normal saline by intravenous infusion over 45 minutes if patients report discomfort 12 hours post-operatively.

Observation Parameters:

1. Onset time of sensory blockade (Time between injection and total abolition of cold sensation) \
2. Total duration of sensory blockade (Time be- tween onset of action and return of cold sensation)
3. Time of onset of complete motor blockade (Time between injection and abolition of upper limb movement up to Modified Bromage grade 3)
4. Total duration of motor blockade (time interval from complete motor block to complete recovery of motor function of hand and forearm, Modified Bromage grade 0)

5. Total duration of analgesia (time between the onset of sensory block and the onset of pain, when the patient received the first dose of analgesic)
6. Any side effects that occurred intraoperatively or during the postoperative period were noted.

Results

The demographic characteristics among the groups were found to be similar and comparable (p>0.05). [Table 1]

Table 1: Demographic data

Variables		**Group A**	**Group B**	**P- Value**
Age (years) (Mean±SD)		37.20±14.5	36.00±13.4	0.733 **(NS)**
Gender	Male	22 (73.30%)	22 (73.30%)	1.00 **(NS)**
	Female	08 (26.70%)	08 (26.70%)	
Weight (kg) (Mean±SD)		63.30±7.7	67.50±4.6	0.133 **(NS)**
Height (cm) (Mean±SD)		165.20±3.0	166.90±3.3	0.050 **(NS)**
BMI (Mean±SD)		23.20±2.3	24.10±1.5	0.093 **(NS)**
ASA grade	I	27 (90.0%)	25 (83.3%)	0.577 **(NS)**
	II	03 (10.0%)	05 (16.7%)	

NS- Non Significant

Duration of surgery and onset of block: The duration of surgery was more in Group A (115.0±60.0 min) compared to Group B (94.0±37.6 min) but found to be statistically insignificant (P=0.213). The onset of sensory and motor block was significantly early in Group B compared to Group A and it is statistically significant (P= 0.003 & 0.021 respectively). The duration of sensory and motor block was significantly prolonged in Group B compared to Group A (P= 0.035 & 0.009, respectively). [Table 2, Fig. 1,2]

Table 2: Duration of surgery and Block characteristics

Variables	**Group A (Mean±SD)**	**Group B (Mean±SD)**	**P value**
Duration of surgery (min)	115.0±60.0	94.0±37.6	0.213 **(NS)**
Onset of Sensory blockade (mins)	4.0±1.2	3.2±0.8	0.003 **(S)**
Onset of Motor blockade (mins)	5.1±1.4	4.3±1.1	0.021 **(S)**
Duration of Sensory blockade (mins)	685.0±127.1	747.7±124.0	0.035 **(S)**
Duration of Motor blockade (mins)	642.0±119.9	717.0±105.9	0.009 **(S)**

NS- Not Significant (p>0.05), S- Significant (p<0.05)

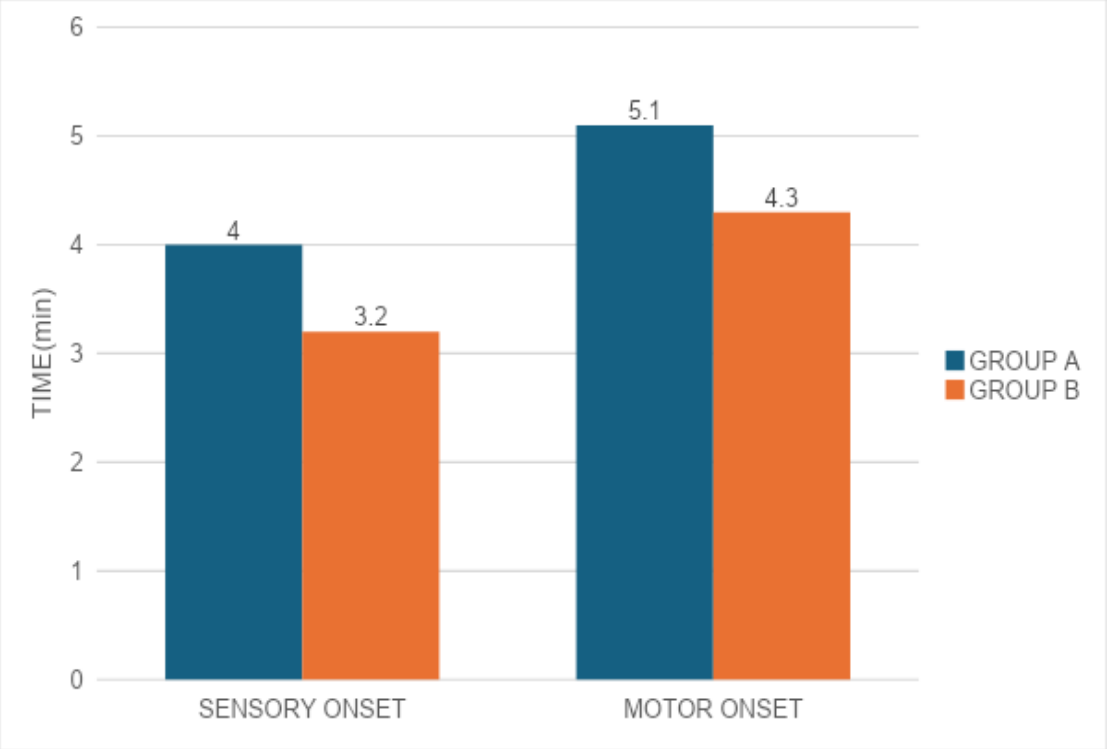

Figure 1: Onset of Sensory and Motor Block

Figure 2: Duration of Sensory and Motor Block

Visual Analogous Score: VAS score was significantly low among group B compared to group A at the end of the 12 hours (P=0.008). [Fig. 3]

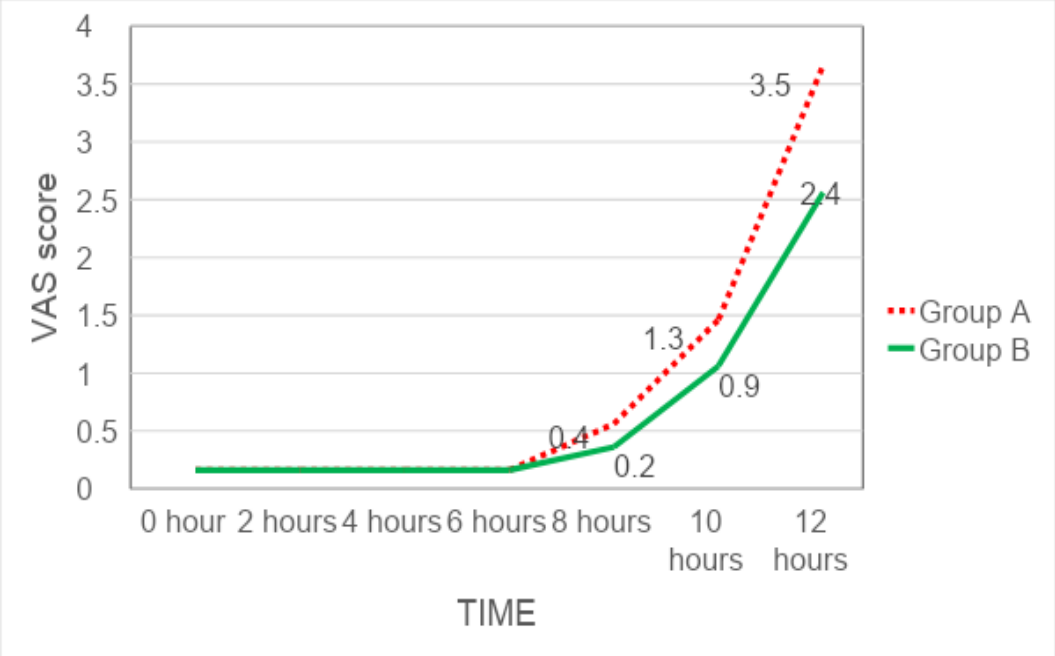

Figure 3: VAS Score Comparison

Association of rescue analgesia: Rescue analgesia was required more in Group A compared to Group B, but it was not statistically significant (P=0.640). [Table 3]

Table 3: Association of rescue analgesia among groups

Rescue analgesia	Group A	Group B	Total	P Value
No	27 (90.0%)	28 (93.3%)	55 (91.7%)	0.640 **(NS)**
Yes	3 (10.0%)	2 (6.7%)	5 (8.3%)	
Total	30 (100.0%)	30 (100.0%)	60 (100.0%)	

NS- Not Significant (p>0.05)

Discussion

This research aimed to compare Dexmedetomidine and Dexamethasone as adjuncts to 0.5% Ropivacaine in ultrasound-guided supraclavicular brachial plexus block for upper limb orthopedic procedures. No substantial differences were seen in age, gender, weight, and height between the two groups. The majority of patients in both groups were classified as ASA 1. Hamed et al. [6] conducted a comparative research on Dexmedetomidine vs fentanyl as an adjunct to local anesthetics in supraclavicular brachial plexus block, assessing the onset and duration of analgesia. No statistically significant differences were seen among the groups

for age, gender, and weight. The aforementioned research is analogous to our study about demographic characteristics. The initiation of sensory and motor blockage was markedly reduced in the dexmedetomidine group vs to the dexamethasone group ($p<0.001$). A research by Chinnappa et al. [7] and Kathuria S et al. [8] on the effectiveness of dexmedetomidine combined with ropivacaine in supraclavicular brachial plexus block revealed that the start of sensory and motor block was more rapid in the dexmedetomidine group compared to the ropivacaine group. Nidhi Singh et al. [5], N.K. Verma and A. Ranjan [9], Krishna Chaitanya et al. [10], Nagaraju A.N. et al. [11], and Swathy S. Iyengar et al. [12] conducted a comparative study on Dexmedetomidine versus dexamethasone as an adjuvant to 0.5% ropivacaine in ultrasound-guided supraclavicular brachial plexus block, revealing that the onset of sensory and motor block was more rapid in the dexmedetomidine group compared to the dexamethasone group ($P < 0.05$). The current investigation demonstrated a substantial prolongation of sensory and motor block duration in Group B compared to Group A ($P= 0.035$ and 0.009, respectively). Vandana Mangal et al. [13] conducted a research on the impact of dexmedetomidine as an adjunct to ropivacaine in the supraclavicular brachial plexus block. Dharmaro P S et al [1] conducted a research comparing dexmedetomidine and fentanyl in conjunction with ropivacaine in ultrasound-guided supraclavicular block. Vijeta Bajpai et al. [14] conducted a meta-analysis of randomized controlled trials evaluating dexmedetomidine and clonidine as adjuncts to local anesthetics in brachial plexus blocks. Shukla U et al [15] conducted a comparison of dexmedetomidine and magnesium sulfate as adjuncts to 0.5% ropivacaine in supraclavicular brachial plexus block. Koraki et al. [16] conducted a research on dexmedetomidine as an adjunct to 0.5% ropivacaine in ultrasound-guided axillary plexus block. Mirkheshti A et al. [17] conducted a 2014 study comparing the effects of dexmedetomidine and ketorolac as adjuvants to local anesthesia on the onset and duration of infraclavicular brachial plexus block. All aforementioned researchers determined that the duration of sensory block, motor block, and overall analgesia was considerably prolonged in the Ropivacaine with dexmedetomidine group compared to the other group ($P<0.05$). In summary, our research indicated that the dexamethasone group need more rescue analgesia compared to the dexmedetomidine group when used as an adjunct to 0.5% Ropivacaine in supraclavicular brachial plexus block. Bharati et al. [18] investigated the efficacy of dexmedetomidine as an adjunct to local anesthetics in supraclavicular brachial plexus block, revealing that the incorporation of dexmedetomidine into ropivacaine-lidocaine extended the duration of the block and significantly reduced the need for rescue analgesics during the 24-hour postoperative period in the dexmedetomidine group ($P < 0.0001$). Sarita S Swami et al. [19] conducted comparative research in 2012 on dexmedetomidine vs clonidine as adjuncts to local anaesthesia in supraclavicular brachial plexus block. The duration of analgesia (time until the need for rescue analgesia) in the Dexmedetomidine group was 456±97 minutes, while in the Clonidine group, it was 289±62 minutes. The difference was statistically significant ($P=0.001$). Dexmedetomidine, when combined with local anesthetic in supraclavicular brachial plexus block, prolonged the duration of sensory and motor blockade. This was like our research. Our research observed no incidence of adverse effects such as bradycardia or hypotension in the post-operative period after the surgery. Wei Dai et al. [20] conducted a meta-analysis on the efficacy and safety of dexmedetomidine in conjunction with ropivacaine in brachial plexus block. More than 12 randomized controlled trials in the meta-analysis indicated that dexmedetomidine, when used as an adjunct to ropivacaine, has

superior analgesic efficacy, characterized by a reduced onset time and prolonged duration, compared to ropivacaine administered alone. Simultaneously, there was no variation in the occurrence of bradycardia and hypotension. This was similar to our research findings.

Conclusion

Dexmedetomidine has a more rapid onset and extends the duration of sensory and motor blockade while reducing post-operative analgesic requirements compared to dexamethasone when used as an adjuvant to ropivacaine in supraclavicular brachial plexus block, without any side effects.

References

1. Dharmarao PS, Holyachi R. Comparative Study of the Efficacy of Dexmedetomidine and Fentanyl as Adjuvants to Ropivacaine in Ultra- sound-Guided Supraclavicular Brachial Plexus Block. Turk J Anaesthesiol Reanim. 2018 Jun; 46(3):208-213. doi: 10.5152/TJAR.2018.980 58. Epub 2017 Jun 1. PMID: 30140517; PMC ID: PMC6097859.
2. Kaur M, Kaur R, Kaur S, Baghla N, Bansal A, Kalia A, Kumar S, Lall A. A Study to Com- pare the Analgesic Efficacy of Dexmedetomi- dine and Fentanyl as Adjuvants to Levobupi- vacaine in Ultrasound-Guided Supraclavicular Brachial Plexus Block. Anesth Essays Res. 2018 Jul-Sep; 12(3):669-673. doi: 10.4103/aer. AER_64_18. PMID: 30283173; PMCID: PMC 6157225.
3. S. Choi, R. Rodseth, C. J. L. McCartney, Ef- fects of dexamethasone as a local anaesthetic ADJUVANT TO brachial plexus block: a sys- tematic review and meta-analysis of random- ized trials, BJA: British Journal of Anaesthe- sia, Volume 112, Issue 3, March 2014, Pages 427–439, https://doi.org/10.1093/bja/aet417
4. Liu, Z., Jiang, M., Xu, T. et al. Analgesic ef- fect of Ropivacaine combined with Dexme- detomidine on brachial plexus block. BMC Anesthesiol 18, 107 (2018). https://doi.org/10. 1186/s12871-018-0570-0
5. Singh N, Gupta S, Kathuria S. Dexmedetomi- dine vs dexamethasone as an adjuvant to 0.5% ropivacaine in ultrasound-guided supraclavicu- lar brachial plexus block. J Anaesthesiol Clin Pharmacol 2020; 36:238-43.
6. Hamed MA, Ghaber S, Reda A. Dexme- detomidine and Fentanyl as an Adjunct to Bu- pivacaine 0.5% in Supraclavicular Nerve Block: A Randomized Controlled Study. Anesth Essays Res. 2018 Apr-Jun; 12(2):475- 479. doi: 10.4103/aer.AER_50_18. PMID: 29962619; PMCID: PMC6020562.
7. Chinnappa J, Shivanna S, Pujari VS, Anan- daswamy TC. Efficacy of dexmedetomidine with ropivacaine in supraclavicular brachial plexus block for upper limb surgeries. J Anaes- thesiol Clin Pharmacol. 2017 Jan-Mar; 33(1):81-85. doi: 10.4103/0970-9185.202196. PMID: 28413277; PMCID: PMC5374835.
8. Kathuria S, Gupta S, Dhawan I. Dexme- detomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block. Saudi J Anaesth. 2015 Apr-Jun; 9(2):148-54. doi: 10.4103/1658-354X.152841. PMID: 2582990 2; PMCID: PMC4374219.
9. Verma NK, Ranjan A. A clinical comparison of dexmedetomidine and dexamethasone as ad- juvant to ropivacaine in supraclavicular bra- chial plexus blocks for upper arm surgeries. Int J Adv Res Biol Sci 2016; 3:56-61.

10. Chaithanya K, Asritha, Reddy N, Sangamithra, A comparative study between 0.375% ropiva- caine with 50mcg of dexmedetomidine and 0.375% ropivacaine with 8mg of dexame- thasone for ultrasound guided supraclavicular brachial plexus block. Indian J Clin Anaesth 2017;4(1):69-73
11. A N, Sahu L, Das S, Muni M. Comparative Evaluation of Dexmedetomidine and Dexame- thasone as Adjuvants in Supraclavicular Bra- chial Plexus Block. Cureus. 2023 May 9; 15(5):e38775. doi: 10.7759/cureus.38775. PMID: 37303417; PMCID: PMC10249913.
12. Iyengar SS, Pangotra A, Abhishek K, Sinha N, Rao NS, Singh VK, Prakash J. The Compari- son of Dexmedetomidine to Dexamethasone as Adjuvants to Bupivacaine in Ultrasound- Guided Infraclavicular Brachial Plexus Block in Upper Limb Surgeries. Cureus. 2023 Jul 10; 15(7):e41668. doi: 10.7759/cureus.41668. PMID: 37575723; PMCID: PMC10412748.
13. Mangal V, Mistry T, Sharma G, Kazim M, Ahuja N, Kulshrestha A. Effects of dexme- detomidine as an adjuvant to ropivacaine in ul- trasound-guided supraclavicular brachial plex- us Block: A prospective, randomized, double- blind study. J Anaesthesiol Clin Pharmacol. 2018 Jul-Sep; 34(3):357-361. doi: 10.4103/ jo- acp. JOACP_182_17. PMID: 30386020; PMCI D: PMC6194815.
14. Bajpai V, Patel TK, Dwivedi P, Bajpai A, Gupta A, Gangwar P, Singh Y, Agarwal R, Kishore S. Dexmedetomidine versus clonidine as an adjuvant to local anaesthetic in brachial plexus blocks: a meta-analysis of randomised controlled trials. Braz J Anesthesiol. 2023 Sep- Oct; 73(5):665-675. doi: 10.1016/j.bjane.20 22.07.005. Epub 2022 Jul 30. PMID: 3591 7846; PMCID: PMC10533961.
15. Shukla U, Singh D, Yadav JBS, Azad MS. Dexmedetomidine and Magnesium Sulfate as Adjuvant to 0.5% Ropivacaine in Supraclavic- ular Brachial Plexus Block: A Comparative Evaluation. Anesth Essays Res. 2020 Oct-Dec; 14(4):572-577. doi: 10.4103/aer.AER_28_21. Epub 2021 May 27. PMID: 34349322; PMCID: PMC8294421.
16. Koraki E, Stachtari C, Kapsokalyvas I, Ster- giouda Z, Katsanevaki A, Trikoupi A. Dexme- detomidine as an adjuvant to 0.5% ropivacaine in ultrasound-guided axillary brachial plexus block. J Clin Pharm Ther. 2018 Jun; 43(3):348-352. doi: 10.1111/jcpt.12657. Epub 2017 Nov 28. PMID: 29193234.
17. Mirkheshti A, Saadatniaki A, Salimi A, Manafi Rasi A, Memary E, Yahyaei H. Effects of dexmedetomidine versus ketorolac as local an- esthetic adjuvants on the onset and duration of infraclavicular brachial plexus block. Anesth Pain Med. 2014 Aug 2; 4(3):e17620. doi: 10.5812/aapm.17620. PMID: 25237638; PMC ID: PMC4165032.
18. Bharti N, Sardana DK, Bala I. The Analgesic Efficacy of Dexmedetomidine as an Adjunct to Local Anesthetics in Supraclavicular Brachial Plexus Block: A Randomized Controlled Trial. Anesth Analg. 2015 Dec; 121(6):1655-60. doi: 10.1213/ANE.0000000000001006. PMID: 264 96366.
19. Swami SS, Keniya VM, Ladi SD, Rao R. Comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind pro- spective study. Indian J

Anaesth. 2012 May; 56(3):243-9. doi: 10.4103/0019-5049.98767. PMID: 22923822; PMCID: PMC3425283.

20. Dai W, Tang M, He K. The effect and safety of dexmedetomidine added to ropivacaine in bra- chial plexus block: A meta-analysis of ran- domized controlled trials. Medicine (Balti- more). 2018 Oct; 97(41):e12573.