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A COMPARATIVE STUDY ON ONSET TIME BETWEEN CLONIDINE VERSUS DEXMEDITOMEDINE AS ADJUVANT TO 0.75% ROPIVACAINE FOR INTRAOPERATIVE ANESTHESIA IN ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

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ABSTRACT **Introduction** Ultrasound guided brachial plexus block gains the advantage of accurate nerve localization, real time visualization of brachial plexus, blood vessels, needle placement, and local anesthetic spread. Ropivacaine was proven to be better anesthetic developed with properties similar to bupivacaine, having lower lipid solubility and less cardiotoxicity. Among many drugs used as adjuvants for faster onset, denser block and for prolonging the duration of peripheral nerve blockade, Clonidine and Dexmedetomidine are found to be effective in recent days. **Aims And Objectives** To compare the onset of sensory and motor blocks, when adding Dexmeditomedine and Clonidine as adjuvants to 0.75% Ropivacaine **Materials And Methods** The present single blinded randomized clinical trial was conducted for a period of 18 months on 64 patients undergoing upper limb surgeries under the assistance of Department of Anaesthesiology at Shridevi Institute of Medical Sciences and Research Hospital, Tumkur. All patients received supraclavicular brachial plexus block under ultrasound guidance by an experienced anaesthesiologist who was blinded to the grouping. The patients were randomized into two groups of 32 subjects each, Group A (receiving Clonidine) and Group B (Dexmedetomidine). **Results** In the present study, the mean age of the subjects was 37.31 ± 9.86 years and 37.13 ± 10.87 years in Clonidine group and Dexmedetomidine group respectively. Majority were males (68.8%), and belonged to ASA grade I (64.1%). The mean BMI was 23.62 ± 2.80 kg/mm2 and 23.66 ± 2.71 kg/mm2 in Clonidine group and Dexmedetomidine group respectively. The mean duration for onset of sensory block among the subjects in Clonidine group was 9.22 ± 1.29 minutes, which was shorter than that of 12.16 ± 1.94 minutes in Dexmedetomidine group. The mean duration for onset of motor block among the subjects in Clonidine group was 11.53 ± 1.67 minutes, which was shorter than that of 15.00 ± 1.87 minutes in Dexmedetomidine group. The study observed statistically significant difference in mean values between the groups, thereby suggesting that Clonidine was successful in providing faster onset of anaesthesia comparatively. **Conclusion** The onset of both sensory and motor blocks was significantly quicker when adding Clonidine compared to that of Dexmeditomedine as adjuvant to 0.75% Ropivacaine.

KEYWORDS : Sensory and motor blocks, onset time, Post-operative analgesia, Dexmeditomedine, Clonidine, 0.75% Ropivacaine

BACKGROUND

The term "spinal anaesthesia of the upper extremity" is frequently used to describe supraclavicular brachial plexus block. Due to its efficiency in regard to cost, effectiveness, margin of safety, and effective post-operative analgesia, it is a widely used anaesthetic technique for a variety of upper limb procedures.[1] With just one injection, it delivers rapid onset, dense anaesthetic to the arm. It guarantees the most efficient upper extremity block and side-effect-free postoperative analgesia. The distal trunk - proximal division level is where it is carried out. The brachial plexus remains congested at this time, and a tiny amount of local anaesthetic causes a quick and reliable blockage of the brachial plexus.[2]

Surgery on the elbow, forearm, and hand will be possible under general anaesthesia thanks to brachial plexus blockade (C5-T1). The principal drawback of these "blind" procedures remains the tiny but significant risk of pneumothorax, despite changes made in the original Kulenkampff method, which has been the subject of several other techniques.[3-5] In the hands of experts, this risk has been claimed to be negligible; nonetheless, some series claim that the incidence of pneumothorax can reach 6.1%.[6,7]

Owing to anatomical variation and otherwise trauma to the area, utilising a landmark strategy for regional blockage can result in inadequate localization of nerves, which can lead to unsuccessful anaesthesia or cause morbidity. Surface ultrasonography can clearly distinguish the brachial plexus' neuronal components as well as its surrounding structures in the upper limb.[8] Accurate nerve localization, real-time brachial plexus, blood vessel, needle placement, and local anaesthetic spread are all benefits of ultrasound guided brachial plexus block. The quantity of needle tries is reduced.[9,10]

Brachial plexus block has been created using a variety of local anaesthetics. Bupivacaine is the most popular one of them because to its increased potency and longer duration of action. Cardiotoxicity is one of the drawbacks, especially when subclavian artery is unintentionally injected. So ropivacaine, which has less cardiotoxicity and a lower lipid solubility than bupivacaine, was created.[11] Numerous medications are utilised as adjuvants to increase the duration and speed up the onset of peripheral nerve blockade. Because of their sedative, analgesic, antihypertensive, and antiemetic effects as well as their reduced need for medication, alpha-2-adrenergic agonists were chosen. The duration of analgesia and anaesthesia in nerves can be prolonged by clonidine, a partial alpha 2 agonist. When used as an adjuvant to local anaesthetic in nerve blocks, dexmedetomidine, a selective alpha 2 agonist with affinity 8 times that of clonidine, has also been found to extend the duration of sensory and motor function.[12] The present study used an ultrasound-guided supraclavicular brachial plexus block using ropivacaine because there isn't much research comparing onset time of clonidine vs dexmedetomidine as an adjuvant.

MATERIALS AND METHODS

Study Area

Department of Anaesthesiology, Shridevi Institute of Medical Sciences and Research Hospital, Tumkur

Study Population

Patients undergoing upper limb surgeries in the study center under the assistance of Department of Anaesthesiology during the proposed study period

Study Design

Single blinded Randomized Clinical Trial

Study Duration

January 2021 to June 2022 for a duration of 18 months

Sample Size Calculation

The sample size was calculated using the findings from a study by Raval et al[41] in the year 2022. The mean duration of analgesia was 11.0 ± 2.4 hours and 14.0 ± 1.6 hours in Group A (Clonidine) and Group B (Dexmedetomidine) respectively. Keeping 95% confidence level and 80% power, the sample size formula was calculated using the following formula;

$$n = \frac{\left(Z_{1-\alpha/2} + Z_{1-\beta}\right)^2 \left(\sigma_1^2 + \sigma_2^2/r\right)}{(\mu_1 - \mu_2)^2}$$

The sample size was estimated to be 31.2, which was rounded up to 32 in each group. That makes the total sample size of 64 subjects.

Sampling Method
Simple Random Sampling

Inclusion Criteria
- Age more than 18 years of either genders
- Body weight of 50 kg and above
- ASA Grade I & II

Exclusion Criteria
- Patient refusal
- Patients having neurological lesions in the upper limb to be operated upon.
- Patients with diabetic neuropathy
- Psychiatric patients
- Patients with history of allergy to local anaesthetics
- Patients with infection/swelling at proposed site of injection
- Patients on alpha blockers or beta blockers
- Patients with bleeding disorders or patients on anticoagulants

METHODOLOGY

Patients who were planned for elective upper limb surgeries with ultrasound guided supraclavicular brachial plexus block, and were eligible for the study according to the above mentioned eligibility criteria were included in the study after informed consent from the patient. Each patient was evaluated according to pre-anaesthetic checkup protocol. The patients were randomized into two groups of 32 subjects each, Group A (receiving Clonidine) and Group B (Dexmedetomidine).

Supraclavicular nerve blockade can be administered by either single shot bolus technique or continuous infusion via catheter placement. In the present study, single shot bolus technique has been considered in providing the supraclavicular nerve blockade.

Addition of 1 µg/kg of dexmedetomidine to 0.75% Ropivacaine 25 ml to a group of 32 patients in contrast to addition of 1 µg/kg of clonidine to 0.75% Ropivacaine 25 ml to another group of 32, for ultrasound guided supraclavicular brachial plexus block. All patients received supraclavicular brachial plexus block under ultrasound guidance by an experienced anaesthesiologist who was blinded to the grouping. After the completion of injection, the needle was withdrawn completely and antiseptic pressure dressing was applied at the site of puncture.

Sensory block was evaluated by Hollmen scale. Motor block achieved was evaluated by Bromage scale. The duration for Hollmen Grade 4 and Bromage Grade 3 were regarded as onset of sensory and motor blocks respectively. The duration for Hollmen Grade 4 and Bromage Grade 3 were regarded as onset of sensory and motor blocks respectively. The duration for Hollmen Grade 1 and Bromage Grade 0 were regarded as duration of sensory and motor blocks respectively.

Hollmen Scale [44]

Grades	Strength
Grade 1	Full sensation
Grade 2	Weak sensation
Grade 3	Recognized as light touch
Grade 4	Loss of sensation

Bromage Scale [45]

Grades	Strength
Grade 0	No block : Total arm & forearm flexion
Grade 1	Partial block : Total forearm and partial arm flexion
Grade 2	Almost complete block : Inability to flex the arm & decreased ability to flex the forearm
Grade 3	Total block : Inability to flex both the arm and forearm

RESULTS

The results obtained from both the groups of patients are entered in Excel.

Table 1: Comparison of onset of sensory block among the study subjects with respect to intervention

Onset of Sensory Block	Group		Total	p-value#
	Clonidine	Dexmed		
Mean	9.22	12.16	10.69	<0.001*
SD	1.29	1.94	2.20	
Median	9.00	12.00	10.00	

Independent t-test
* Statistically significant

In the study, the onset of sensory block was observed in terms of duration required for complete loss of sensation. The mean duration for onset of sensory block among the subjects in Clonidine group was 9.22 ± 1.29 minutes, which was shorter than that of 12.16 ± 1.94 minutes in Dexmedetomidine group. The study observed statistically significant difference in mean values between the groups, thereby suggesting that Clonidine was successful in causing sensory block quicker comparatively.

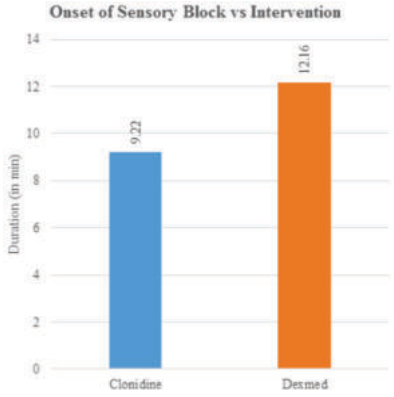

Figure 1: Bar diagram comparing mean onset of sensory block among the study subjects with respect to intervention

Table 2: Comparison of onset of motor block among the study subjects with respect to intervention

Onset of Motor Block	Group		Total	p-value#
	Clonidine	Dexmed		
Mean	11.53	15.00	13.27	<0.001*
SD	1.67	1.87	2.48	
Median	12.00	15.00	13.00	

Independent t-test
* Statistically significant

In the study, the onset of motor block was observed in terms of duration required for complete loss of motor function. The mean duration for onset of motor block among the subjects in Clonidine group was 11.53 ± 1.67 minutes, which was shorter than that of 15.00 ± 1.87 minutes in Dexmedetomidine group. The study observed statistically significant difference in mean values between the groups, thereby suggesting that Clonidine was successful in causing motor block quicker comparatively.

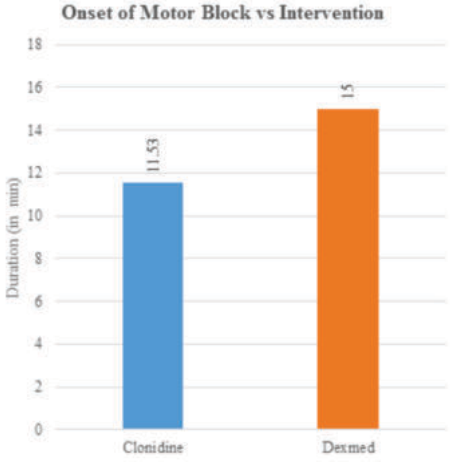

Figure 2: Bar diagram comparing mean onset of motor block among the study subjects with respect to intervention

DISCUSSION

The present single blinded randomized clinical trial was conducted for a period of 18 months on 64 patients undergoing upper limb surgeries under the assistance of Department of Anaesthesiology at Shridevi Institute of Medical Sciences and Research Hospital, Tumkur. The patients were randomized into two groups of 32 subjects each, Group A (receiving Clonidine) and Group B (Dexmedetomidine).

Addition of 1 µg/kg of dexmedetomidine to 0.75% Ropivacaine 25 ml to a group of 32 patients in contrast to addition of 1 µg/kg of clonidine to 0.75% Ropivacaine 25 ml to another group of 32, for ultrasound guided supraclavicular brachial plexus block. All patients received supraclavicular brachial plexus block under ultrasound guidance by an experienced anaesthesiologist who was blinded to the grouping. The duration for Hollmen Grade 4 and Bromage Grade 3 were regarded as onset of sensory and motor blocks respectively. The duration for Hollmen Grade 4 and Bromage Grade 3 were regarded as onset of sensory and motor blocks respectively.

In the present study, the mean age of the subjects was 37.31 ± 9.86 years and 37.13 ± 10.87 years in Clonidine group and Dexmedetomidine group respectively. Overall, the mean age of the subjects was 37.22 ± 10.30 years. This can be compared to the findings from the study by Steby CR et al[44], where the mean age of the subjects was 34.2 ± 10.1 years and 35.0 ± 9.5 years in Clonidine group and Dexmedetomidine group respectively. However, few studies such as Eisenach et al[31], Paula et al[35], and Bajwa et al[33], have showed varied age presentations, and this is due to the fact that the type of surgery performed changes in different studies.

Majority of the subjects in the present study belonged to ASA grade I in both Clonidine group (68.8%) and Dexmedetomidine group (59.4%). Overall, ASA grade I cases were observed in majority (64.1%), followed by ASA grade II (35.9%). The study did not find significant difference in proportions between the groups with respect to ASA grading, thereby eliminating the selection bias. This is almost universal because most of the surgeries with experimental trials tend to include ASA grade I subjects in majority, and this can be substantiated from the findings in the study by Eisenach et al[31], Yu-Nan Lin et al[36] and Raval et al[41].

In the present study, the onset of sensory and motor block was observed in terms of duration required for complete loss of sensation and motor function. The mean duration for onset of sensory block among the subjects in Clonidine group was 9.22 ± 1.29 minutes, which was shorter than that of 12.16 ± 1.94 minutes in Dexmedetomidine group. On other hand, the mean duration for onset of motor block among the subjects in Clonidine group was 11.53 ± 1.67 minutes, which was shorter than that of 15.00 ± 1.87 minutes in Dexmedetomidine group. The study observed statistically significant difference in mean values between the groups, thereby suggesting that Clonidine was successful in causing both sensory and motor block quicker comparatively. However, few studies such as Solanki et al, Patil S et al[45], Bafna et al[46], and Bapista et al[32], have doubted the efficacy of clonidine in causing early blockade of sensory and motor functions.

CONCLUSION

Comparing the effect of addition of clonidine versus dexmedetomidine as adjuvants to 0.75 % ropivacaine in supraclavicular brachial plexus block for upper limb surgeries, based on onset and duration of sensory block. The onset of both sensory and motor blocks was significantly quicker when adding Clonidine compared to that of Dexmedetomidine as adjuvant to 0.75% Ropivacaine

REFERENCES

1. Winnie AP, Collins VJ: The Subclavian Perivascular Technique of Brachial Plexus Anesthesia. Anesthesiology 1964; 25: 353-63
2. Franco C. Supraclavicular Brachial Plexus Block. In Hadzic: Textbook of Regional Anesthesia and Acute Pain Management. McGraw Hill, 2007, pp418-425
3. Kulenkampff D: Brachial Plexus Anaesthesia: Its Indications, Technique, and Dangers. Ann Surg 1928; 87: 883-91
4. Brown DL, Cahill DR, Bridenbaugh LD: Supraclavicular nerve block: anatomic analysis of a method to prevent pneumothorax. Anesth Analg 1993; 76: 530-4
5. Murphey DR: Brachial Plexus Block Anesthesia: An Improved Technic. Ann Surg 1944; 119: 935-43
6. Franco CD, Vieira ZE: 1,001 subclavian perivascular brachial plexus blocks: success with a nerve stimulator. Reg Anesth Pain Med 2000; 25: 41-6
7. Brand: A comparison of supraclavicular and axillary techniques for brachial plexus blocks. Anesthesiology 1961; 22: 226-229
8. Sheppard DG, Iyer RB, Fenstermacher MJ. Brachial plexus: demonstration at US. Radiology 1998; 208:402-406
9. Yang WT, Chui PT, Metreweli C. Anatomy of the normal brachial plexus revealed by sonography and the role of sonographic guidance in anesthesia of the brachial plexus. AJR Am J Roentgenol 1998; 171:1631-1636
10. Ootaki C, Hayashi H, Amano M. Ultrasound-guided infraclavicular brachial plexus block: an alternative technique to anatomical landmark-guided approaches. Reg Anesth Pain Med 2000; 25: 600-604
11. Sarkar DJ, Khurana G, Chaudhary A, Sharma J P. A comparative study on the effects of adding fentanyl and buprenorphine to local anaesthetics in brachial plexus block. Journal of Clinical and Diagnostic Research. 2010;4(6):3337–43.
12. Eledjam JJ, Deschodt J, Viel EJ, Lubrano JF, Charavel P, d'Athis F, et al. Brachial plexus block with bupivacaine: Effects of added alpha-adrenergic agonists: Comparison between clonidine and epinephrine. Can J Anaesth. 1991;38:870–5
13. Mueller JP. Regional anesthesia in perspective. Peripheral Nerve Blocks and Peri-Operative Pain Relief E-Book: Peripheral Nerve Blocks and Peri-Operative Pain Relief: ExpertConsult Online and Print. 2010 Oct 13:7.
14. Angaramo G, Savage J, Arcella D, Desai MS. A Comprehensive Curriculum of The History of Regional Anesthesia.
15. Urmey WF. Upper extremity blocks. In: Brown DL, editor. Regional Anaesthesia and Analgesia. Philadelphia: W.B.Saunders, 1996:254- 278.
16. Moore KL, Agur AM. Essential Clinical Anatomy. 3rd ed. Baltimore: Lippincott Williams & Wilkins; 2007.
17. Gray, Henry. Anatomy of the Human Body. Philadelphia: Lea & Febiger; 1918. Bartleby.com 2000
18. Warwick R, Williams PL. Gray's Anatomy. 35th ed. London: Longman; 1979. p. 1046
19. Marhofer P, Harrop-Griffiths W, Kettner SC, Kirchmair L. Fifteen years of ultrasound guidance in regional anaesthesia: part 1. British journal of anaesthesia. 2010 May 1;104(5):538-46.
20. Bhargava SK. Principles and practice of ultrasonography. Jaypee Brothers Medical Publishers; 2020 Sep 30.
21. Sauter AR, Dodgson MS, Stubhaug A, Halstensen AM, Klaastad Ø. Electrical nerve stimulation or ultrasound guidance for lateral sagittal infraclavicular blocks: a randomized, controlled, observer-blinded, comparative study. Anesthesia & Analgesia. 2008 Jun 1;106(6):1910-5.
22. Morgan and Mikhail's clinical anesthesiology. McGraw Hill Medical; 2022.
23. Pester JM, Hendrix JM, Varacallo M. Brachial plexus block techniques. InStatPearls [Internet] 2022 Nov 30. StatPearls Publishing.
24. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. Indian journal of anaesthesia. 2011 Mar;55(2):104.
25. Bansal T, Hooda SA. Ropivacaine-a novel and promising local anaesthetic drug. Asian J Pharm Clin Res. 2012;5(Suppl 1):13-5.
26. Ståhle H. A historical perspective: development of clonidine. Best Practice & Research Clinical Anaesthesiology. 2000 Jun 1;14(2):237-46.
27. Lowenthal DT, Matzek KM, MacGregor TR. Clinical pharmacokinetics of clonidine. Clinical pharmacokinetics. 1988 May;14:287-310.
28. Asano T, Dohi S, Ohta S, Shimonaka H, Iida H. Antinociception by epidural and systemic α2-adrenoceptor agonists and their binding affinity in rat spinal cord and brain. Anesthesia & Analgesia. 2000 Feb 1;90(2):400-7.
29. Eisenach JC, Shafer SL, Bucklin BA, Jackson C, Kallio A. Pharmacokinetics and pharmacodynamics of intraspinal dexmedetomidine in sheep. Anesthesiology. 1994 Jun 1;80(6):1349-59.
30. Marhofer P, Brummett CM. Safety and efficiency of dexmedetomidine as adjuvant to local anesthetics. Current Opinion in Anaesthesiology. 2016 Oct 1;29(5):632-7.
31. Eisenach J, Detweiler D, Hood D. Hemodynamic and analgesic actions of epidurally administered clonidine. Anesthesiology. 1993 Feb 1;78(2):277-87.
32. de Abreu Baptistal JF, Gomez RS, PauloIII DN, CarrarettoIV AR, BroccoV MC, SilvaVI JJ. Epidural anesthesia with ropivacaine with or without clonidine and postoperative pain in hemorrhoidectomies1. Acta Cirúrgica Brasileira. 2014 Mar 1;29(3):2014-3.
33. Bajwa SJ, Bajwa SK, Kaur J. Comparison of epidural ropivacaine and ropivacaine clonidine combination for elective cesarean sections. Saudi journal of anaesthesia. 2010 May;4(2):47.
34. Alves TC, Braz JR. Clinical evaluation of clonidine associated to ropivacaine for epidural anesthesia. Revista brasileira de anestesiologia. 2002;52:410-9.
35. Salgado PF, Sabbag AT, Silva PC, Brienze SL, Dalto HP, Módolo NS, Braz JR, Nascimento Jr P. Synergistic effect between dexmedetomidine and 0.75% ropivacaine in epidural anesthesia. Revista da Associacao Medica Brasileira (1992). 2008 Mar 1;54(2):110-5.
36. Lin YN, Li Q, Yang RM, Mao ZX, Liu JC. Addition of dexmedetomidine to ropivacaine improves cervical plexus block. Acta Anaesthesiologica Taiwanica. 2013 Jun 1;51(2):63-6.
37. Oriol-Lopez SA, Maldonado-Sanchez KA, Hernandez-Bernal CE, Castelazo-Arredondo JA. Peridural dexmedetomidine in local anesthesia in order to decrease anxiety. Revista Mexicana de Anestesiología. 2008;31(4):271-7.
38. Jain D, Kumar N, Khan RM, Kumar D. Perioperative effect of epidural dexmedetomidine with intrathecal bupivacaine on haemodynamic parameters and quality of analgesia. Southern African Journal of Anaesthesia and Analgesia. 2012 Mar 1;18(2):105-9.
39. Bajwa SJ, Bajwa SK, Kaur J, Singh G, Arora V, Gupta S, Kulshrestha A, Singh A, Parmar SS, Singh A, Goraya SP. Dexmedetomidine and clonidine in epidural anaesthesia: A comparative evaluation. Indian journal of anaesthesia. 2011 Mar;55(2):116.
40. 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 prospective study. Indian journal of anaesthesia. 2012 May;56(3):243.
41. Raval DL, Kartik N. A comparative study between dexmedetomidine and clonidine used as adjuncts to bupivacaine for post-operative analgesia by caudal block in paediatric patients. Asian Pac J Health Sci. 2014;1(2):131-6.
42. 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. British journal of anaesthesia. 2009 Aug 1;103(2):268-74.
43. Abdallah FW, Brull R. Facilitatory effects of perineural dexmedetomidine on neuraxial and peripheral nerve block: a systematic review and meta-analysis. British journal of anaesthesia. 2013 Jun 1;110(6):915-25.
44. Lee R, Kim YM, Choi EM, Choi YR, Chung MH. Effect of warmed ropivacaine solution on onset and duration of axillary block. Korean Journal of Anesthesiology. 2012 Jan 1;62(1):52-6.
45. Bromage PR. A comparison of the hydrochloride and carbon dioxide salts of lidocaine and prilocaine in epidural analgesia. Acta Anaesthesiologica Scandinavica 1965; 9(Suppl. 1): 55–69.