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Original Research Article

A Comparative Study between the Efficacy of Clonidine and Dexmedetomidine Used as Adjuvant to Ropivacaine for Brachial Plexus Block by Supraclavicular approach for Upper Limb Surgery

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Abstract

Introduction: Peripheral nerve block of the upper extremity with local anesthetic agent along with analgesic adjuvant produce intense nerve block for surgical procedure and also produce good postoperative analgesia.

Aims & Objective: The objectives of this study were to compare the effects of Inj. Ropivacaine, Inj. Ropivacaine with Clonidine, Inj. Ropivacaine with Dexmedetomidine as adjuvants, used for Supraclavicular approach of brachial plexus block with respect to onset, duration of motor and sensory block, duration of analgesia and untoward side effects.

Methods: 40 patients were allocated in following groups and Brachial plexus block were administered in Group R with 0.5% ropivacaine (3mg/kg) + normal saline to make total 40ml volume, Group C with 0.5%ropivacaine(3mg/kg) + 1mcg/kg of clonidine + normal saline to make total 40 ml volume and Group D - with 0.5% ropivacaine (3mg/kg) + 1mcg/kg of dexmedetomidine + normal saline to make total 40ml volume. All demographic and Vital parameters of the patients. time of onset and duration of sensory & motor block and degree of sedation at intervals of 0, 5, 10, 20, 30, and 120 min were monitored.

Results: The onset of sensory and motor block was shortest in Gr D. The duration of sensory and motor block the duration of postoperative analgesia was longest in Gr D and shortest in Gr R. There was a significant difference in sedation score at 10 and 30 mins between Gr R and Gr C and also between Gr R and Gr D. There was no difference between Gr C and Gr D in sedation score.

Conclusion: Insupraclavicular brachial plexus block, adding Dexmedetomidine (1mcg/kg) as an adjuvant to ropivacaine (0.5%) results in faster onset and longer duration of sensory and motor block with longer duration of analgesia than the addition of clonidine.

Introduction

The administration of regional anesthesia and blocking of peripheral nerves has gained its importance because it decreases the intensity of pain in the postoperative period, the need for postoperative analgesic medications and the incidence of postoperative sickness.

The choice of regional anaesthesia depends upon the limb to be operated on, the duration of the surgery, ambulation requirements and desired duration of pain control in the postoperative period [1,2] A variety of well-established traditional ways to block the brachial plexus exist, namely interscalene, supraclavicular, infraclavicular, and axillary techniques depending upon the anatomical site of the block [1-3].

Among these techniques, supraclavicular block gains most popularity as it is the easiest to apply. At this point, the brachial plexus is very compact, and a little volume of local anesthetic produces a dense block of the entire upperlimb with a short period of onset of surgical block [3,4]. The success of regional anaesthesia depends upon the deposition of a local anaesthetic agent close to the targeted nerve [1,4]. The use of nerve locator or ultrasound has improved the success rate, but failure or incomplete block is not rare following supraclavicular brachial plexus block [5,6].

Selection of local anesthetic drug along with analgesic adjuvant for regional nerve block produces intense block for surgical procedure and also good postoperative analgesia. Previous studies have evaluated either Ropivacaine with Clonidine or Ropivacaine with Dexmeditimidine as an adjuvant in comparison to Ropivacaine alone for Brachial Plexus Block. In our study, we had three groups for comparison to reach a definite conclusion regarding the efficacy of the local anesthetic drug and the adjuvants in the brachial plexus block.

Aims and Objectives

The objectives of this study are to compare the effects of Inj. Ropivacaine, Inj. Ropivacaine with Clonidine, Inj. Ropivacaine with Dexmedetomidine as adjuncts, used for Supraclavicular approach of brachial plexus block with respect to onset, duration of motor and sensory block, duration of analgesia and untoward adverse effects.

Material and Methods

This double-blind, prospective, observational study was conducted after obtaining informed consent and ethical committee clearance. Total of 120 Patients aged between 40 to 60 years, weighing 50 to 60 kg of ASA class I & II physical status and posted for upper extremity orthopedic surgery was taken in this study each group containing 40 patients. Routine proper active investigations were done and patients were allocated by computer-generated random technique in following groups and anaestheia was administered in: Group R –with 0.5% ropivacaine(3mg/kg) + normal saline to make total 40ml volume, Group C –with 0.5%ropivacaine(3mg/kg) + 1mcg/kg of clonidine +normal saline to make total 40ml volume and Group D - with 0.5% ropivacaine(3mg/kg)+ 1mcg/kg of dexmedetomidine+ normal saline to make total 40ml volume. Intravenous access

was obtained, and baseline vital parameters were recorded. Patients having any contraindication of regional nerve block and having bilateral upper limb surgery were not included in our study. The patient was lying in the supine position and the surgical arm is adducted and the hand extended along the side towards the ipsilateral knee. Under through asepsis, local infiltration of anaesthetic drug is performed at the site of the nerve. and a 5 cm, 22-gauge needle is introduced in the parasagittal plane at the superior border of the clavicle. Locating the nerve with a nerve locator the anesthetic solution was injected keeping the needle in a fixed position and patients were kept under observation. After 30 minutes if the block was considered to be adequate, the surgeons' tourniquet was applied, and surgery was started. If the block was inadequate for surgery, the patient was given general anaesthesia and was excluded from the study. Patients were monitored for any adverse effects/complications. Patients were asked to document the time when incisional discomfort began and the time when full power returned to the shoulder, the duration of post-operative analgesia (until the patient asks for the first dose of rescue analgesia). Sensory block was evaluated by pinprick, the motor block was evaluated by Bromage Scale and sedation was assessed by Ramsay sedation Score. The duration of analgesia, defined as the time between the onset of action of block and onset of pain was the time when patients received the first dose of analgesic (visual analogue scale score > 4).

Statistical Analysis

All demographic and basic clinical parameters including pulse, blood pressure, and O_2 saturation. time of onset and duration of sensory & motor block and degree of sedation at intervals of 0, 5, 10, 20, 30, and 120 min were monitored. The duration of post-operative analgesia was also measured. Data were entered in Microsoft Excel and Statistical Analysis was done using SPSS, IBM Version 23. ANOVA was used to find the homogeneity of demographic parameters and Study parameters. The unpaired t-test test was used to find the pair-wise significance between the three groups. Alpha level was taken at 5%, with a confidence level of 95%, and p-value of <0.05 was taken as significant.

Numerical data were analysed using the ANOVA test, with inter-group comparisons done by Post-Hoc Tukey. Categorical data were analysed using the Chi-Square test and the Fischer-Exact test.

Results

In our study, the difference in demographic variability (Age, sex, body weight, height, and ASA status) was non-significant in all three groups (P>0.05). Regarding the onset of the sensory block, there were significant differences between the three groups as the p-value was<0.05. The onset was fastest in GR D and slowest in GR R (Table 1). The onset of the motor block had significant differences between the three groups as the p-value was<0.05. The onset was fastest in GR D and slowest in GR R (Table 2). There were also significant differences in the duration of the sensory block between the three groups as the p-value was <0.05. The duration was longest in GR D and shortest in GR R (Table 3). We also observed significant differences in the duration of the motor block between the three groups as the p-value was<0.05.

The duration was longest in GR D and shortest in GR R (Table 4). The duration of postoperative analgesia was longest in GR D and shortest in GR R and there were significant differences between the three groups as the p-value was<0.05 (Table 5). A comparison of MAP (mm Hg) between three groups at different points of time showed

that there were no significant differences among the three groups at different points as every time p value was >0.05.

There was a significant difference in sedation score at 10 min between GR R and GR C and also between GR R and GR D as in both cases p <0.05. There were no differences between GR C and GR D as p>0.05 (Table 6). The findings for sedation score were the same in 20 min and 30 min (Table 7,8).

Table 1: Shows average onset of sensory block in three groups

	GROUPS			p-value			
	GR R	GR C	GR D				
	Mean±SD	Mean±SD	Mean±SD	R vs C	R vs D	C vs D	Overall
ONSET TIME (Min)	14.2±2.49	11.7±1.76	10.15±1.67	0.000	0.000	0.000	0.000

Table 2: Shows the average onset of motor block in three groups.

	GROUPS			p-value			
	GR R	GR C	GR D				
	Mean±SD	Mean±SD	Mean±SD	R vs C	R vs D	C vs D	Overall
ONSET TIME (Min)	18.1±1.58	13.5±1.74	10.9±1.53	0.000	0.000	0.000	0.000

Table 3: Shows the average duration of sensory block in three groups.

	GROUPS			p-value			
	GR R	GR C	GR D				
	Mean±SD	Mean±SD	Mean±SD	R vs C	R vs D	C vs D	Overall
Duration (Min)	369.78±10.57	567.4±84.61	637.78±13.4	0.000	0.000	0.000	0.000

Table 4: Shows the average duration of motor blocks in three groups

	GROUPS			p-value			
	GR R	GR C	GR D				
	Mean±SD	Mean±SD	Mean±SD	R vs C	R vs D	C vs D	Overall
Duration (Min)	337.15±8.67	530.75±12.24	585.25±13.56	0.000	0.000	0.000	0.000

Table 5: Shows the average duration of analgesia in three groups

	GROUPS			P- value			
	GR R	GR C	GR D				
	Mean±SD	Mean±SD	Mean±SD	R vs C	R vs D	C vs D	Overall
Duration (Min)	465.15±9.73	550.93±16.94	667.7±12.96	0.000	0.000	0.000	0.000

Table 6: Shows significant differences in sedation score at 10 mins in all three groups

		GROUP			TOTAL	P value			
		GR R	GR C	GR D		R vs C	R vs D	C vs D	Overall
Sedation score at 10 mins	Score1	40	34	34	108	0.064	0.064	1.00	0.035
	Score2	0	6	6	12				
TOTAL		40	40	40	120				

Table 7: Shows significant differences in sedation score at 20 mins in all three groups

		GROUP			TOTAL	P value			
		GR R	GR C	GR D		R vs C	R vs D	C vs D	Overall
Sedation score at 20 mins	Score 1	40	33	32	105	0.044	0.018	0.936	0.012
	Score 2	0	7	8	15				
TOTAL		40	40	40	120				

Table 8: Shows significant differences in sedation score at 30 mins in all three groups

		GROUP			TOTAL	P value			
		GR R	GR C	GR D		R vs C	R vs D	C vs D	Overall
Sedation score at 30 mins	Score 1	40	33	32	105	0.044	0.018	0.936	0.012
	Score 2	0	7	8	15				
TOTAL		40	40	40	120				

Discussion

William Stewart Halsted7in 1885 first administered the brachial plexus block for upper limb surgery after exposing the roots under local infiltration and injecting each of them with a small amount of dilute cocaine (0.1%) interneural. Kulenkampff [8] described the first percutaneous supraclavicular approach and in 1949, Bonica and Moore [9,10] utilized Kulenkampff's and Patrick's technique and developed a technique where it begins with utilizing the classical landmarks and direction of needle insertion and demands definite paresthesia prior to the first injection. Electrical stimulation of peripheral nerves during nerve block became common in the 1970s as a means to locate peripheral nerves and plexus with greater precision [11,12].

A variety of receptor-mediated nociception on peripheral sensory axons and the peripheral administration of appropriate drugs (adjuvant) have the analgesic benefit without systemic adverse effects or prolonged motor block allowing a reduction in the total dose of local anesthetic used. Novel analgesic adjuncts used till date include epinephrine, bicarbonate, calcium-channel blockers, clonidine, opioids, neostigmine, magnesium sulphate, tramadol, dexmeditomidine and so on [13]. Effective postoperative pain control is one of the essential components for the patients. Afferent neural blockade with local anaesthetics with adjuvants is the most effective analgesic technique. [14,15]

α 2- adrenergic mechanism of analgesia [16,17] has been explained for more than 100 years. Cocaine first used spinal anaesthesia produces analgesia primarily by its local anaesthetic action but also inhibits Norepinephrine reuptake, in part by enhancing Noradrenergic stimulation of α 2-adrenergic receptor. One clinical trial was conducted by Murphy and Damien [18] in 2000 by adding various adjuncts like opioids and Clonidine to local anaesthetic agents. Among them, Clonidine in axillary brachial plexus block delayed the onset of pain postoperatively twofold and provided better analgesia without adverse effects when used in a dose up to 150µg. Daniel M. Popping *et al*, [19] in their meta-analysis of randomized trials, concluded as, Clonidine when added to both intermediate-acting and long-acting local

anesthetics for peripheral nerve or plexus block, prolongs the duration of postoperative analgesia by about 2 hours. When Clonidine is added to Ropivacaine, prolongation of the motor block will be shorter than when added to Bupivacaine.[20] B. Das, M. Lakshmegowda, and M. Sharma [21] 2016 conducted a study on brachial plexus block with Dexmeditomodine and ropivacaine and concluded that Dexmedetomidine along with ropivacaine decreases the onset of motor and sensory block and increases the duration of sensory and motor block in supraclavicular brachial plexus block. In our study, we also found that Clonidine and dexmeditomidine both used with Ropivacaine have produced early onset sensory and motor block with prolonged postoperative analgesia.

In another study, Nasir, Dawood; Gasanova, Irina; Drummond, Shaina *et al.* [22] 2017 concluded that clonidine significantly prolongs the duration of ropivacaine effects for postoperative analgesia in patients who underwent upper arm surgeries. In 2019, Nazir O., Bhat A.H., Sharma, T., Khatuja A. and Misra [23] observed the addition of clonidine and dexmedetomidine to 0.5% ropivacaine are effective in supraclavicular brachial plexus block. These results are similar to our study results with respect to all the parameters compared. However, dexmedetomidine is a better alternative to clonidine as an adjuvant for 0.5% ropivacaine in to obtain early onset and prolong the duration of sensory and motor block and good postoperative analgesia.

Limitations

In our study, only ASA I & II patients who were having only upper extremity orthopedic surgery were included. ASA III & IV patients with polytrauma and systemic diseases were excluded. A multicentric study involving these patients with a large sample size can only give a more reliable conclusion.

Conclusion

The addition of Dexmedetomidine(1mcg/kg) as an adjuvant to ropivacaine (0.5%) results in faster onset and longer duration of sensory and motor block and longer duration of analgesia than the addition of clonidine. There was no significant difference in haemodynamic variables i.e., heart rate, mean arterial pressure and O_2 saturation.

References

1. Miller R. D. (2015). Miller Anaesthesia. 8th edition, Philadelphia, ELSEVIER
2. Morgan EG, Mikhail MS, Murray MJ. Peripheral nerve blocks: Clinical anaesthesiology, 4th ed. New Delhi: Tata McGraw-Hill; 17.2009.
3. Bridenbaugh CMJ. Neural blockade in clinical anaesthesia and pain medicine. 4th ed. Lippincott Williams and Wilkins; 2009.
4. Dang PC. A novel of supraclavicular approach to brachial plexus block. Anesth Analg 1997;85(1):111-6.
5. Mulroy MF, Bernards CM, Mcdonald SB, Salinas FV. Regional Anaesthesia, fourth edition, Lippincott Williams and Wilkins; page 185- 188.
6. Duncan M, Setti AN, Krishnaveni N *et al*. A comparative study of nerve stimulator vs ultrasound guided supraclavicular brachial plexus block: Anaesthesia, essays and research. 2013; 7(3): 359-364.
7. A Lopez Valverde, J De Vicente, A Cutandoet,al. The sugeons Halsted and Hall, cocaine and the discovery of dental anaesthesia by nerve blocking. Br Dental Journal 2011 Nov 25; 211(10):485-87.
8. Kulenkampff D, Persky M, Brachial Plexus Anaesthesia, its indications, techniqueand dangers. Ann Surg 1928; 87: 883-891.
9. Bonika J J and Moore D C – Brachial plexus block Anesthesia – American Journal of Surgery. 1949; 78: 65-79.
10. Winnie AP. Historical consideration. Chapters 2 and 4. Plexus Anaesthesia.

New York: Churchill Livingstone 1984; 1:43-116:192-202.
11. Champan GM, Regional nerve block with the aid of a nerve stimulator. Anesthesia 1972; 27:185-93. Wiley Online Library / CAS /PubMed.
12. Duncan M, Setti AN, Krishnaveni N *et al*. A comparative study of nerve stimulator vs ultrasound guided supraclavicular brachial plexus block. Anaesthesia, essays and research 2013; 7(3):359-364.
13. G V Krishna Prasad, SangeetaKhanna, Sharma VipinJaishree: Review of adjuvants to local anesthetics in peripheral nerve blocks: Current and future trends.Saudi Journal Anesthe. 2020 Jan-Mar; 14(1):77 – 84.
14. Girish Joshi, Kishore Gandhi, Nishant Shah, Jeff Gadsden *et al*. Peripheral nerve blocks in the management of postoperative pain: challenges and opportunities, Journal of Clinical Anesthesia, December 2016:35:524-529.
15. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. IJA. 2011 Mar-Apr; 55(2):104-10.
16. Eisenach JC, De Kock M, Klimscha W: Alpha (2)-adrenergic agonists for regional anaesthesia. A clinical review of Clonidine (1984-1995). Anesthesiology 1996; 85:655–74.
17. Eisenach JC, De Kock M, Klimscha W: Alpha (2)-adrenergic agonists for regional anaesthesia. A clinical review of Clonidine (1984-1995). Anesthesiology 1996; 85:655–74.
18. Damien B. Murphy, Colin J. L. McCartney, and Vincent W. S. Chan: Novel Analgesic Adjuncts for Brachial Plexus Block:A Systematic Review. AnesthAnalg 2000; 90:1122–8.
19. Daniel M. Popping, Nadia Elia, Emmanuel Marret, Manuel Wenk, Martin R. Trame. A Meta-analysis of Randomized Trials. Clonidine as an Adjuvant to Local Anesthetics for Peripheral Nerve and Plexus Blocks. Anesthesiology, Aug 2009; V 111: No 2.
20. Asad Mohammad, Sangeeta Goel, Anurag Singhal, Vibhor Rae: Clonidine as an Adjuvant to Ropivacaine in Supraclavicular Brachial Plexus Block: A Randomised Double Blinded Prospective Study. International Journal of Contemporary Medical Research. May 2016;3(5):129.
21. B. Das, M. Lakshmegowda, M. Sharma, S. Mitra, R. Chauhan Revista. Supraclavicular brachial plexus block using ropivacaine alone or combined with dexmedetomidine for upper limb surgery: A prospective, randomized, double-blinded, comparative study. Española de Anestesiologíay Reanimación, March 2016; 63(3): 135-140.
22. Clonidine, but not Dexamethasone, Prolongs Ropivacaine-Induced Supraclavicular Brachial Plexus Nerve Block Duration. Authors: Nasir, Dawood; Gasanova, Irina; Drummond, Shaina; Alexander, Current Clinical Pharmacology, 2017; 12(2): 92-98(7).
23. Nazir, O., Bhat, A.H., Sharma, T., Khatuja, A. and Misra: Comparison of clonidine and dexmedetomidine as adjuvants for ropivacaine in supraclavicular brachial plexus block. Sri Lankan Journal of Anaesthesiology, 2019;27(1):53–58.