



COMPARATIVE STUDY OF ROPIVACAINE AND LAEOBUPIVACAINE WITH CLONIDINE AS AN ADJUVANT IN INFRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR LOWER ARM SURGERIES

Dr Srihari Gutte

Senior resident Department of Anaesthesiology Government medical College Aurangabad

Dr Rajashri B. Sonwane*

Associate Professor Department of Anaesthesiology Government Medical College Aurangabad *Corresponding Author

ABSTRACT

Introduction: Infraclavicular block is a safe and simple technique for providing surgical anaesthesia of the lower arm with an efficacy comparable to other brachial plexus block Ropivacaine and

Levobupivacaine has similar efficacy to bupivacaine with enhanced safety profile. Clonidine improves the reliability and efficacy of peripheral nerve block.

Aims and Objectives: To compare the block characteristics of ropivacaine and laevobupivacaine with clonidine as an adjuvant in infraclavicular brachial plexus block.

Material and Methods: For this prospective study, 60 patients were randomized into two groups, Group A-0.5% ropivacaine 30 cc and inj. clonidine 1ug/kg and Group B-0.5% laevobupivacaine 30cc and inj. clonidine 1ug/kg and infraclavicular brachial plexus block was given. The onset of sensory block, motor block, the duration of sensory block and motor block, the quality of surgical anaesthesia, the duration of postoperative analgesia, VAS score, haemodynamic parameters and side effects were observed.

Results: Onset of sensory block and motor block was earlier with laevobupivacaine. Duration of sensory and motor block was longer in laevobupivacaine group. Quality of surgical analgesia was excellent in 100% in both groups. Duration of post operative analgesia was same in both groups. Haemodynamically patients were stable and there were no significant side effects seen in either groups.

Conclusion: Laevobupivacaine with clonidine and ropivacaine with clonidine are comparable in infraclavicular brachial plexus block for lower arm surgeries.

KEYWORDS : infraclavicular brachial plexus block, ropivacaine, laevobupivacaine, clonidine

INTRODUCTION:

Orthopedic upper arm surgeries forms a significant group of orthopedic trauma. The surgeries can be done under general anaesthesia or regional anaesthesia. Regional anaesthesia has several advantages over general anaesthesia like improved postoperative pain, decreased post operative opioid administration and reduced recovery time.¹ Anaesthesiologist has a choice of technique for providing anaesthesia and analgesia during upper extremity surgery by brachial plexus block through various routes like interscalene, supraclavicular, infraclavicular and axillary.

Systematic reviews have shown that infraclavicular block is a safe and simple technique with efficacy comparable to other brachial plexus block. The advantage of infraclavicular block includes a lower likelihood of tourniquet pain during surgery and more reliable blockade of the musculocutaneous and axillary nerve and significantly shorter block performance time.²

Ropivacaine the single S isomer long acting amide local anaesthetic is well tolerated regional anaesthetic, effective for surgical anaesthesia as well as relief of post operative pain. The efficacy of ropivacaine is similar to that of racemic bupivacaine and levobupivacaine for peripheral nerve blocks.³

Levobupivacaine, another single S isomer amide local anaesthetic has similar efficacy but an enhanced safety profile when compared to bupivacaine, a major advantage in regional anaesthesia. Both drugs are useful in clinical situations where risk of systemic toxicity related to overdosing or unwanted intravascular injection is high as during peripheral nerve block.⁵

Ropivacaine and laevobupivacaine in peripheral nerve block provide comparable clinical profile and post operative analgesia while other studies show that levobupivacaine produce approximately 30% longer duration in each modality and long lasting analgesia.⁵

Clonidine, an alpha 2 adrenergic agonist helps to improve the reliability and efficacy of regional anaesthesia⁷ prolonging duration of block⁸ and perineural use is recommended.⁹

The rationale of the study was to find out efficacy and safety of ropivacaine and laevobupivacaine with clonidine as an adjuvant when used in infraclavicular block for lower arm surgeries.

MATERIAL AND METHODS:

This was a prospective, randomized, double blind study. Institutional ethical committee approval was taken. Source of study population was patients posted for elbow and forearm surgeries. Sample size calculated was 60. Convenient sample was used. Screening of patient done and patient fulfilling inclusion criteria like age 20-60 yrs of either gender, height of 150-170 cm, weight 50-70 kg, ASA grade I and II were included. Exclusion criteria were allergy to local anaesthetics, history of drug abuse, neurological disease, cardiac disease, chronic obstructive disease, diabetes mellitus and local infection at puncture site. After taking informed consent, patients were randomized by computer generated random number table into two groups, Group A-Inj Ropivacaine 0.5%, 30cc and Inj. Clonidine 1ug/kg and Group B-Inj. Laevobupivacaine 0.5%, 30 cc and inj. Clonidine 1ug/kg. Group allocation concealment done by opaque sealed envelope technique. The drugs syringes were prepared by a resident who did not take part in further study. A senior resident performed all the blocks. The principal investigator who was blind to group allocation recorded the study parameters.

On day of surgery, infraclavicular brachial plexus block was given by coracoid approach. A 10cm 20g insulated needle attached to nerve stimulator (NSML 100, INMED) was inserted. Initial stimulating current was set at 0.6-0.8mA. The brachial plexus was reached at 4cm-6cm and stimulating current was then decreased to elicit motor response at 0.3mA. Only motor

response (twitches) from the triceps, forearm muscles were accepted prior to local anaesthetic injection. Aspiration was performed and loading dose administered incrementally. The patient was withdrawn from study in case of failure of onset of block.

Sensory block assessed by 23g hypodermic needle by Hollmen scale, 1-normal sensation of pinprick, 2-weaker sensation of pinprick, 3-pinprick recognized as touch by blunt object, 4- no perception of pinprick. Motor block evaluated by bromage scale, grade 1-ability to flex and extend the forearm, grade 2-ability to flex and extend only the wrist and fingers, grade 3-ability to extend only the fingers, grade 4-inability to move the forearm, wrist and fingers. Quality of surgical block assessed by need of supplemental anaesthesia. Excellent-no supplementary sedative and analgesic required, good-only sedative required, fair-both sedative and analgesic required, poor-general anaesthesia required.

Postoperative analgesia was assessed by using visual analogue scale (0mm-no pain to 100 mm-worst pain imaginable). Duration of analgesia taken from inj. of local anaesthetic to need of rescue analgesia. Patients heart rate, systolic blood pressure, respiratory rate, oxygen saturation monitored. Also patient observed for accidental intravascular injection of drug, pleural puncture, anaphylaxis to local anaesthetic drugs. Patient observed for postoperative side effects like nausea, vomiting, shivering, pruritus, dyesthesia, peripheral neuropathy.

Statistical Analysis:

For analysis of this data SPSS (Statistical Software for social Sciences) software version 20th was used.. Demographic data was represented in form of mean, SD and percentages. It was analyzed using chi-square test to check association between two drugs, chi square test for trend and Fisher Exact test depending on type of data. For comparison of quantitative variables of two groups, unpaired t-test was used and it was also represented in form of mean and SD etc. The duration of surgery and duration of analgesia was analyzed and evaluated by One Way ANOVA. Vital parameters like pulse rate, systolic blood pressure, respiratory rate, oxygen saturation were analyzed by Unpaired t test. Statistical significance was indicated by conventional symbols: p <0.05: Statistically significant, p >0.05: Statistically non-significant.

RESULTS:

Demographic parameters like age, gender, weight, height, BMI, ASA grade, duration of surgery were comparable in the two groups.(table 1)

Table 1: Demographic Characteristics

Demographic Parameters	Group A (n=30) Mean ± S.D.	Group B (n=30) Mean ± S.D.	P value
Age (years)	34.37 ± 10.516	36.87 ± 11.74	0.38
Male (%)	22 (73.3%)	21 (63%)	-
Female (%)	08 (26.7%)	09 (27%)	
Weight (kg)	60.00 ± 6.878	58.80 ± 7.540	0.52
Height (cm)	159.27 ± 6.40	159.27 ± 6.400	0.99
BMI	23.73 ± 3.085	23.14 ± 2.40	0.41
Grade I ASA	25 (83.3%)	26 (86.70%)	> 0.05
Grade II	05 (16.7%)	04 (13.3%)	
Duration of surgery	118 ± 31.55	119.83 ± 43.51	0.91

There was statistically significant difference between group A and group B when onset time of sensory block considered (p<0.0001). There was statistically significant difference in mean time of onset of motor block when group A and B compared (p<0.0001). Regarding duration of sensory

block the difference was statistically significant (p<0.0001). The duration of motor block was statistically significant when group A and group B compared (p<0.0001). A statistically non-significant difference was observed amongst the groups regarding duration of analgesia (p=0.08). At 10th hr, mean VAS scores were more than 3 in both groups and statistically not significant (p = 0.746). (table 2)

Table 2: Nerve block characteristics

Block characteristics	Group A Mean ± SD	Group B Mean ± SD	t-value	P-value
Onset of sensory Block	3.58 ± 0.631	1.07 ± 0.173	21.012	0.0001
Onset of motor Block	7.53 ± 0.571	2.33 ± 0.467	38.88	0.0001
Duration of sensory Block	426 ± 24.011	507.33 ± 19.46	-18.37	0.0001
Duration of motor Block	393 ± 20.536	488.67 ± 17.76	-19.30	0.0001
Duration of analgesia	618 ± 27.96	634 ± 40.73	-1.77	0.08
VAS score at 10 th hr	2.67 ± 0.547	2.63 ± 0.490	0.30	0.746

The quality of surgical anaesthesia in group A and group B was excellent in 100% of patients. (table 3)

Table 3: Quality of Surgical anaesthesia

Scale	Group A (%) (n=30)	Group B (%) (n=30)	P Value
Excellent	30 (100%)	30 (100%)	>0.05
Good	00	00	
Fair	00	00	
Poor	00	00	

On comparison, no statistically significant difference was found in both the groups with respect to pulse rate (p value >0.05) (chart 1) or with respect to systolic blood pressure (p value >0.05). (chart 2)

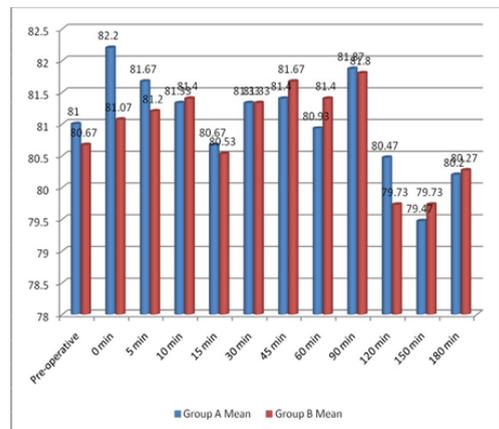


Chart 1: Heart Rate at Different Time Intervals (Beats per Minute)

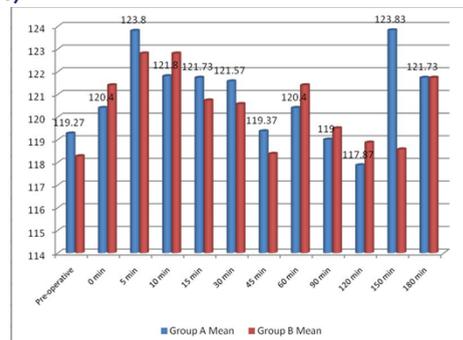


Chart 2: Systolic blood pressure at different time intervals (mm Hg)

Two patient in each group complained of nausea and vomiting. Two patient in group A and one patient in group B complaint of vomiting. One patient of each group had pruritus. Incidence was found to be statistically insignificant amongst the groups ($p > 0.05$).

DISCUSSION:

In our study, demographic parameters like age, gender, height, weight, BMI, ASA grade, duration of surgery were comparable and similar to many other studies. In congruence to our study, sensory block onset was earlier with levobupivacaine¹⁰ in one study, early with ropivacaine in another study^{11, 12} but few studies had equal onset in both groups^{13,14,15,16}. Similar to our study, motor block onset was early with laevobupivacaine¹⁰ but in other study early with ropivacaine^{11,17} and equal in both groups in remaining studies^{12,14,15}. Onset is related to the intrinsic physicochemical properties of individual local anaesthetic agents. Physicochemical properties include the pKa and hydrophobicity of local anaesthetics. Ropivacaine is about 10 times less lipophilic than levobupivacaine and is resistant to rapidly penetrating myelinated nerve fibres.¹⁸ When onset time compared for sensory and motor block, it was earlier with sensory block as small myelinated axons, A gamma and A delta sensory fibres are most susceptible to block followed by large myelinated A alpha and A beta fibres¹⁸

Similar to our study, sensory block duration was longer with levobupivacaine,^{14,17} but equal duration in both groups seen in one study¹⁹. Similar to our study, duration of motor block was longer with levobupivacaine^{14,16} while other studies found equal duration in both groups.^{15,19,20} Duration of block is influenced by the peripheral vascular effects of local anaesthetic drugs. Many local anaesthetic drugs have a biphasic action on vascular smooth muscle. They cause vasoconstriction at lower concentration and vasodilatation at higher concentration. Effect of local anaesthetics on vascular tone and regional blood flow are complex and vary according to concentration, time, particular vascular bed, among other factors.¹⁸

Similar to our study quality of surgical anaesthesia was comparable in few studies^{12,1,17,19} but high success with ropivacaine seen in one study.¹¹ Dissimilar from our finding one study needed intraoperative supplementation of analgesics.¹⁹ Small diameter axons such as C fibres concerned with touch, pain are often stated to be more susceptible to local anaesthetic block than large diameter fibres such as A fibres, concern with motor and proprioception.¹⁸ Duration of analgesia was found to be of equal duration^{10,12,15,19,20} similar to our study but other studies found prolonged analgesia with laevobupivacaine^{13,14,16}. Similar to our study VAS score was equal in other studies^{10,15,19,20}

It is widely believed that benefit of adding clonidine is to improve the quality of block. Studies comparing ropivacaine and ropivacaine with clonidine has shown advantage in few block characteristics^{21,22} while other studies did not found advantage in some block parameters.²² by adding clonidine Studies comparing laevobupivacaine and laevobupivacaine with clonidine found advantage of clonidine²³ but other study found no advantage.²⁴ Study with clonidine added to both groups showed prolonged duration of analgesia and delayed need of rescue analgesics in laevobupivacaine-clonidine group²⁵ which did not agree with our study.

In a study comparing intravenous versus perineural clonidine there was no difference in onset but duration of analgesia prolonged with intravenous clonidine. Clonidine acts on alpha 2 receptors in the central nervous system that is locus coeruleus and dorsal horn of spinal cord. Alpha 2 receptors are not present in the normal peripheral nerves.²⁶ Data

regarding effect of peripheral clonidine on quality of surgical anaesthesia is inadequate. In our study we think clonidine in dose of $\mu\text{g}/\text{kg}$ contributed to excellent quality of surgical anaesthesia.

Haemodynamic parameters stable and comparable in both groups¹⁴ similar to our study. In our study minimal side effect seen while other studies did not show side effects.^{14,16}

CONCLUSIONS:

Laevobupivacaine with clonidine and ropivacaine with clonidine provides comparable brachial plexus block by infraclavicular route for lower arm surgeries.

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