www.jmscr.igmpublication.org
Index Copernicus Value: 79.54
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossrefDOI: https://dx.doi.org/10.18535/jmscr/v7i2.174

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

A Comparative Study of the Anesthetic Efficacy, Post Tourniquet Release Analgesia and Side Effects of Ropivacaine 0.2% & Lignocaine 0.5% in Intravenous Regional Anesthesia for Hand Surgeries

Authors
A Gowri Shankar[1], Satish Logidasan[2], Arulraj G.P[3], Karthik.A[4], S Prasana Vathanan[5], Ambal S[6], C.Sathish[7], Karthick S R[8]
Corresponding Author
Kanimozhi R
Department of Anesthesiology, Govt Stanley Medical College, TN- 600001, India
Email: *rfrooti@yahoo.co.in*

Abstract
Intravenous regional anaesthesia technique in which analgesia and muscle relaxation are produced by the injection of an adequate volume of local anaesthetic solution into vein of an extremity with inflow and outflow of the blood prevented by a tourniquet. Ropivacaine 0.2% in intravenous regional anaesthesia improved the anaesthetic efficacy, lengthened post tourniquet analgesia, reduced the amount of post operative rescue analgesia and had less side effects as compared to lignocaine 0.5% which has been proved statistically significant using quantitative and qualitative analysis.

Introduction

The history of intravenous regional anaesthesia had begun with august bier, who described the technique in 1908. But in 1970 after lapse of 62 years, the technique was modified and popularised by holmes as bier block"[2]. lignocaine has been the drug most frequently used for intravenous regional anaesthesia. lignocaine is considered a less toxic local anaesthetic. it is used intravenously for treating ventricular arrthymias in the dose of 1-2 mg/kg safely and also used for attenuating stress response to endotracheal intubation[3]. however in intravenous regional anaesthesia, reactions like convulsions, coma, cardiorespiratory depression and cardiac arrest have been reported following injection of the local anaesthetic, because of either tourniquet failure or after the release of the tourniquet.

A longer acting agent, such as bupivacaine, initially gained substantial popularity for use of intravenous regional anaesthesia but was laden with potentially serious side effects. Several deaths have been reported from the use of bupivacaine in intravenous regional anaesthesia when high dose of bupivacaine administered.

Bupivacaine has been identified as a fast-in, slow – out type of local anaesthetic that maintains a high affinity and binds tightly to myocardial sodium receptors. Therefore, if high plasma concentrations of bupivacaine are achieved, cardiac arrest may occur, which frequently has preoved to be irreversible. Due to the increased potential for central nervous system toxicity for lignocaine and the ration of dosages needed for CVS: CNS toxicity for bupivacaine is low, there is a need for a better drug which could replace these two.[7]

The amide local anaesthetic ropivacaine is a pure s-enantiomer and is structurally realed to bupivacaine .the duration of effect of ropivacaine is similar to that of bupivacaine , and ropivacaine has been shown to result in less depression of the cardiac conduction system when compared with bupivacaine .intravenous ropivacaine ,compared with bupivacaine and lignocaine in several volunteer studies, has less cardiac and central nervous system (CNS)side effects but has achieved surgical anaesthetic conditions.

Therefore, ropivacaine may serve as a local anaesthetic for intravenous regional anaesthesia that could provide prolonged and improved analgesia over lignocaine and has a lower toxicity profile when compared with bupivaine[6,7]. ropivacine 0.2% and lignocaine 0.5% were used in intravenous regional anaesthesia for hand surgeries, and the anaesthetic efficacy, post-touniquet release analgesia and side effects were evaluated.

Aim of the Study

The aim of the study is to compare

1. The anaesthetic efficacy,
2. Post tourniquet release analgesia,
3. Side effects of ropivacaine 0.2% and lignocaine 0.5%, when used in intravenous regional anaesthesia for hand surgeries.

Materials and Methods

This study was conducted in 40 patients undergoing hand surgeries in plastic surgery department. After getting institutional ethical committee approval and after explaining the procedure in detail, informed consent obtained from every patient. The patients were assigned into two groups each containing 20 patients.

Group 1: the patients in this group received 40 ml of 0.5% lignocaine

Group 2: patients in this group received 40 ml of 0.2% ropivacaine

Selection of patients:

The patients selected for this study were of ASA I and II, undergoing elective and emergency hand surgeries.

Exclusion Criteria

Patients with history of any cardiovascular, respiratory or central nervous system disorders were excluded from the study. Patients with haematological disorders like sickle cell anaemia and thalassemia, patients with known hypersensitivity to lignocaine and ropivaine and patients with difficult airway were excluded from the study.

Pre anaesthetic assessment

Physical status of all patients were preoperatively assessed. A thorough airway assessment was done. The following investigations were done on the patients.

1) Hemoglobin
2) Urine analysis
3) Blood sugar
4) Blood urea and serum creatinine
5) Chest x-ray
6) Electrocardiogram

Procedure

The patients were shifted into the operation theatre. The pulsoximeter, non invasive blood pressure monitor and electrocardiographic monitor were connected to the patients. The vital parameters were recorded

A separate intravenous line was started in the onn-operated limb. aveinin the dorsum of the hand of the operated limb was cannulated with 22g intravenous cannula. if the dorsum of the hand involved in the surgery, a vein higher up in the forearm was chosen. it was firmly fixed, flushed with normal saline and stopper applied .

Exsanguination was accomplished by elevation of the limb for 5 minutes followed by esmarchbandage from fingertip to arm. in subjects where application of esmarch bandage was not feasible, emptying of veins was fecilitated with compression of axillary artery with the limb elevated 3. At the proximal end of esmarchbandage, the first tourniquet was apllied around the upper part of the arm over cotton wool padding. then the tourniquet was inflated to 250 mmhg. circulatory isolation of the arm was verified by inspection, absence of radial pulse and loss of pulse oximeter traceing of the ipsilateral index

finger. Then 40 ml of local anaesthesia solution was injected through the cannula at a rate of 1ml/second. After ensuring complete analgesia below the first tourniquet, the second tourniquet was applied distal to the first tourniquet and inflated to 250 mm hg.

The first tourniquet was then removed .The patients were observed for any toxic manifestations of local anaesthetics after release of the first tourniquet. The following parameter were recorded.

Time of onset of sensory block:

It is the time elapsed from injection of study drug to sensory block achieved in all dermatomes of the operated limb. this was checked by pinprick every minute till the onset of sensory block.

Time of onset of motor block:

It is the time elapsed from injection of study drug to inability of voluntary movements in the operated limb. this was checked by asking the patient to flex the elbow and hand every minute till the onset.

Time of sensory block recovery (residual analgesia)

It is the time elapsed from tourniquet deflation to recovery of pain in all dermatomes of the operated limb.

Time of motor block recovery

It is the time elapsed from tourniquet deflation to ability of voluntary movements in the operaqqted limb.

Assessment of tourniquet pain

Assessment of tourniquet pain made on the basis of visual analaogue scale (VAS), where 0=no pain and 10=worst imaginable pain. tourniquet pain was measured after tourniquet application and 5.10.20.40 minutes after injection of the study drug.

Duration of postoperative pain relief:

The time elapsed from tourniquet release to the first dose of rescue analgesic inj.diclofenac sodium.

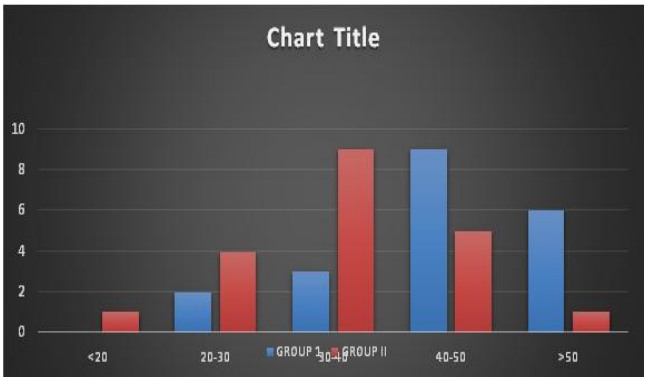
Total dose of analgesic inj.diclofenac in mg for the first 24 hours postoperatively.

At the end of surgery, tourniquet deflation was performed using cyclic deflation method, that is the tourniquet was deflated 3 times for 10 seconds separated by 1 minute intervals of reinflation. the patients were carefully observed for possible side effects during and after the release of tourniquet 21.the tourniquet was not deflated before 30 minutes and was not inflated for more than 90 minutes. The total duration of tourniquet and surgery was noted .the patients were followed up for 24 hours postoperatively[11].

Observation and results

Age distribution

Age distribution in yrs	Group I	Group II
<20	0	1
20-30	2	4
30-40	3	9
40-50	9	5
>50	6	1
TOTAL	20	20

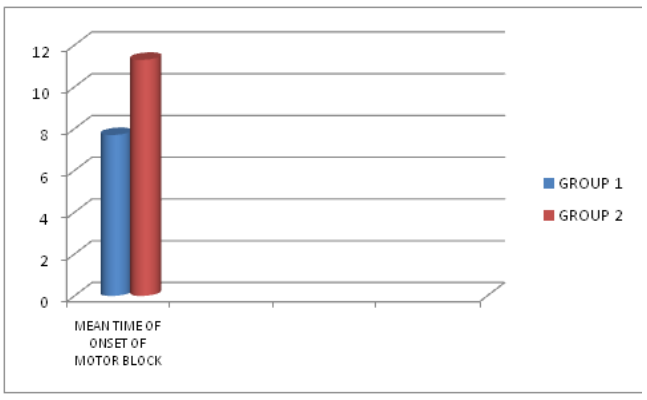


Time of onset of Sensory Block

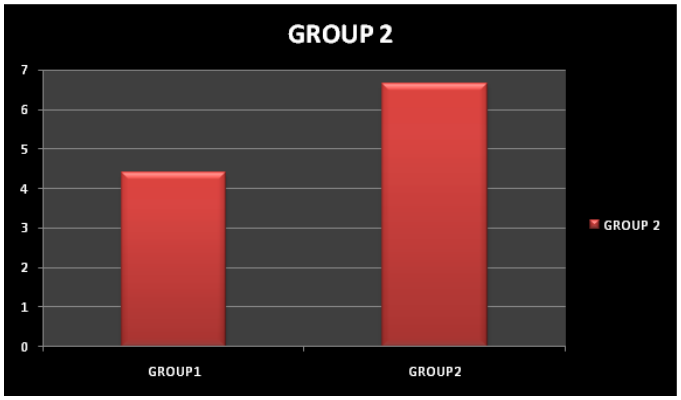
Time of Onset of Sensory Block In Minutes	GROUP I	GROUP II
<3	2	0
3-5	16	2
5-7	2	13
>7	0	5

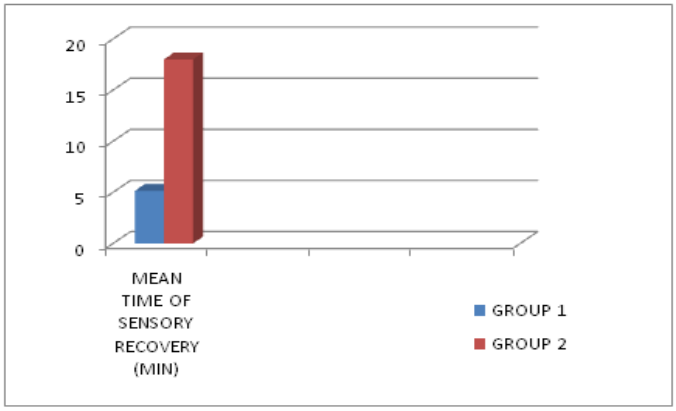
Mean time and standard deviation of sensory block onset in group 1is 4.40+/-1.095 (independant sample test)

Mean time and standard deviation of sensory block onset in group 2 is 6.65+/-1.182(p value is <0.05 statistically significant)



The mean time required for onset of sensory block in group 2 was more than group 1.





Time of onset of Motor Block

TIMEOF ONSET OF MOTOR BLOCK IN MINUTES	GROUP 1	GROUP 2
<3	0	0
3-5	0	0
5-10	20	7
>10	0	13

Mean time of onset of motor block in group 1 is 7.70+/-1.261

Mean time of onset of motor block in group 2 is 11.30+/-1.720

(p value is <0.05 statistically significant by paired t test)

The mean time is required for onset of motor block was more in group 2 than group 1

Time of Sensory Block Recovery

TIMEOF ONSET OF SENSORY BLOCK RECOVERY IN MINUTES	GROUP 1	GROUP 2
<5	14	0
5-10	6	1
10-20	0	11
>20	0	8

Mean time of sensory block recovery in group 1 is 5.15+/-0.933

Mean time of sensory block recovery in group 2 is 18+/-3.974 (p value is 0.000 i.e p<0.05 which is statistically significant by paired t- test)

The mean time is required for sensory block recovery in group 2 is much higher than group 1. These finding showed that ropivacaine 0.2% has longer sensory recovery time than lignocaine 0.5%.

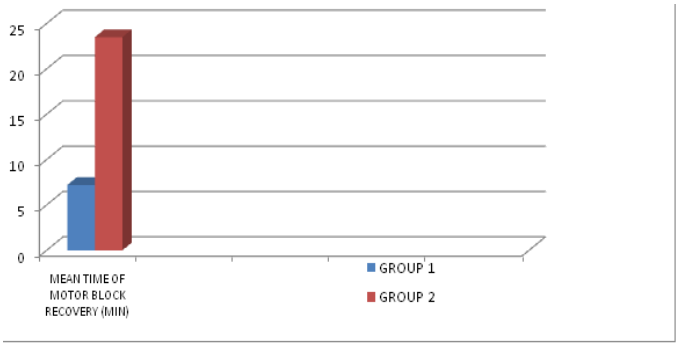
Time of Motor Block Recovery

TIMEOF ONSET OF MOTOR BLOCK RECOVERY IN MINUTES	GROUP 1	GROUP 2
<5	0	0
5-10	20	0
10-20	0	4
>20	0	16

Mean time of motor block recovery in group 1 is 7.20+/-0.951

Mean time of motor block recovery in group 2 is 23.50+/-3.720 (p value is 0.000 i.e p<0.05 which is statistically significant by paired t- test)

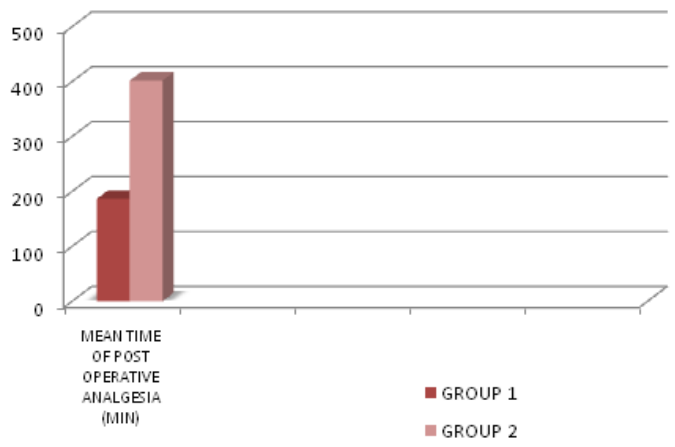
The mean time is required for motor block recovery in group 2 is much higher than group 1. These finding showed that ropivacaine 0.2% prolongs the motor block recovery time than lignocaine 0.5%.



Mean Time of Post Operative Analgesia

GROUP	MEAN TIME AND STANDARD DEVIATION OF POST OPERATIVE ANALGESIA (MIN)
GROUP 1	186.50 +/- 25.500
GROUP 2	401.75 +/- 27.638

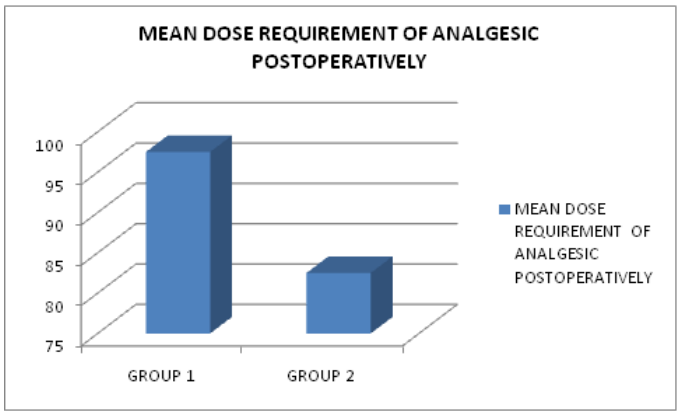
Meantime of postoperative analgesia in group 2 is more than group 1. These findings showed that ropivacaine 0.2% has prolonged post operative analgesia than lignocaine 0.5%.



Mean Dose Requirement of Analgesia Post Operatively

GROUP	MEAN DOSE OF ANALGESIC POST OPERATIVELY (mgs)
GROUP 1	97.50 +/- 30.75
GROUP 2	82.5 +/- 38.1

Mean dose requirement of analgesic postoperatively in group 2 was less than group 1. P value is 0.05 (statistically significant by Chi-square test)



Side effects	Group 1	Group 2
Tinnitus	0	0
Light headedness	1	1
Perioral numbness	1	0
Vomiting	1	0
Nausea	2	0
Somnolence	0	0
Vertigo	0	0
Skin rashes	0	0
Arrhythmias	0	0
Convulsions	1	0

Side effects in group 2 was less than group 1. One patient in lignocaine group had convulsions due to tourniquet failure. Patient resuscitated with Inj Midazolam 3mg and Inj Thiopentone sodium 100mg. Then mask ventilated with 100% oxygen. Patient recovered completely.

Discussion

When general anaesthesia is contraindicated, regional anaesthesia would be approach 28.one such regional anaesthetic technique used in upper limb surgeries is intravenous regional anaesthesia .this technique was chosen for this study considering the following merits.

1) Simple technique –insertion of IV cannula is the only necessary skill required.
2) Reliable and effective when properly used
3) Rapid onset of action.
4) Rapid and prompt recovery from tourniquet release.
5) Good analgesia and adequate muscle relaxation.
6) Provides bloodless operative field.
7) Widely applicable to patients of different ages and physical status.

Contraindication

1) Patient refusal
2) Absence of resuscitative equipments and drugs
3) Allergy to local anaesthetics
4) Infection and cellulitis in the limb to be blocked
5) Conditions precluding use of tourniquet like
   a) Scleroderma
   b) Hemolytic diseases such as sickle cell anaesmia, thalassemia
   c) Raynauds disease
   d) Malignanacy
6) Lengthy procedure
7) Patients with seizure disorders or with cardiac disorders30

Intravenous regional anaesthesia is an ideal technique for short operative procedures on the extremities. use of intravenous regional anaesthesia has been limited because of local anaesthetic toxicity, slow onset, poor muscle relaxation, tourniquet pain and minimal postoperative pain relief. To improve the quality of intravenous regional anaesthesia, the use of a newer drug has been tried.

In our study it was planned to compare efficacy of ropivacaine 0.2 % with lignocaine 0.5% inintravenous regional anaesthesia for hand surgery and the sensory block onset time, sensory block recovery time, motor block onset and recovery time, tourniquet pain, post tourniquet release analgesia time, and dose requirement of rescue analgesic postoperatively were observed.

In our study there was no significant difference between the two groups for blood pressure, pulse rate during preoperative and intraoperative time.

In our study the sensory block onset time was more in ropivacaine group (6.65+/-1.182min) when compared to lignocaine (4.40+/-1.095 min) which was consistent with the findings of T.T. Nieme et al (2006)

Our study showed the motor block onset time was more in ropivacaine group than in lignocaine group.the finding coincides with the results found by maxmilian et al. they showed that the m otor block onset time in lignocaine (10+/-min) group was lesser than in ropivacaine(15+/-12min). Sensory block was much prolonged when ropivacaine 0.2 % used. this finding correlated with the results found by chan and Vincent et al (1999). our study showed the mean duration of post tourniquet analgesia was more in ropivacaine (401.75+/-27.5).the duration of post block analgesia after 0.2@ropivacaine was 344+/-28 minutes in the study concluded by chan et al.

Philip peng et al (2002) stated that the motor block recovery time was prolonged in the ropivacaine 0.2% group when compared to lignocaine 0.5 % group. our study also proved that the mean time of motor block recovery in ropivacaine group 23.5+/-3.720)was prolonged than ijlignocanine group (7.20+/-0.951)

In our study, there was no difference between the two age groups in scores for pain after tourniquet inflation , and at 5, 10,15 min but at 20 and 40min,there was a significant decrease in tourniquet pain score in ropivacaine group. this finding correlated with the findings made by Ibrahim asif et al. in our study . the duration of postoperative analgesia was longer in ropivacaine 0.2 % group (401.75+/-27.5 min)than lignocaine 0.5%group (186.50+/-25.5 min).this finding correlated with the results of maximilian et al . and the mean dose of rescue analgesiac (diclofenac in mg) was less in ropivacaine group (82.5%+/-38.1) than in lignocaine (97.5+/-30.75).these findings also coincide with the results of atanaseoff et al who showed that the number of patients taking more than two tablets of tramadol (each 100mg) was less in ropivacaine 0.25%group when compared to lignocaine 0.5% group.

Ropivacaine was found to have less complications in comparison to ligniocaine which is consistent with the study of scott et al and kndson et al 23. Hence in our study it was found that ropivacaine 0.2 %in intravenous regional anaesthesia improved the anaesthestic efficacy, lengthened post tourniquet analgesia, reduced the amount of post operative rescue analgesic and had less side effects with good intraoperative hemodynamics as compared to lignocaine 0.5%.

Summary

Ropivacaine 0.2% in intravenous regional anaesthesia improved the anaesthetic efficacy, lengthened post tourniquet analgesia, reduced the amount of post operative rescue analgesia and had less side effects as compared to lignocaine 0.5%which has been proved statistically significant using quantitative and qualitative analysis.

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