ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
Index Copernicus Value: 68 . 16
PubMed - National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 4, Issue – 6, November - 2019, Page No. : 116 - 122

Comparative Evaluation of 0.5% Ropivacaine And 0.5% Levobupivacaine in Adductor Canal Block For Patients Undergoing Knee Arthroscopic Surgery

[1]Brinda Valecha, Senior Resident, Department of Anaesthesia and Critical Care, VMMC and Safdarjang Hospital, New Delhi.

[2]Dharam Singh Meena, Professor, Department of Anaesthesia and Critical Care, VMMC and Safdarjang Hospital, New Delhi.

[3]Arushi Gupta, Associate Professor, Department of Anaesthesia and Critical Care, VMMC and Safdarjang Hospital, New Delhi.

[4]Vibhuti Sharma, Asstt. Professor, Department of Anaesthesia and Critical Care, VMMC and Safdarjang Hospital, New Delhi.

Corresponding Author: Dharam Singh Meena, Professor, Department of Anaesthesia and critical care, VMMC and Safdarjang Hospital, New Delhi.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Providing pain relief to patients undergoing knee arthroscopic is important to enable early ambulation and shorten the length of hospital stay. Among the various analgesic modalities, nerve blocks are considered safe and effective. FNB and ACB are used these days for post-operative analgesia in patients undergoing knee arthroscopic surgery. ACB spares the quadriceps muscle strength and is thus considered to be superior to FNB. Various local anaesthetics have been used in these blocks e. g . Lignocaine Mepivacaine, Bupivacaine and Ropivacaine. In view of paucity of literature of use of Levobupivacaine in ACB, we compared it with Ropivacaine in our study.

Methods: After obtaining a written informed consent, 90 patients aged 18 to 65 years, of either sex and of ASA grade 1 and 2, scheduled to undergo elective knee arthroscopic surgery, were included in the study and randomized in two groups. In Group A, ACB given using 20ml of 0.5%Levobupivacaine And in Group B, ACB given using 20ml of 0.5% Ropivacaine.

The Arthroscopic surgeries (ACL repair-Single or Double bundle) were carried out under spinal anaesthesia. The adductor canal block was given under Ultrasound guidance after completion of surgery.

Duration of block was noted from time of administration of the ACB. .Pain was assessed by VAS at 4, 6, 8, 12 and 24hrs.Both the groups were compared in terms of duration of analgesia (time between the end of local anaesthetic administration and the first analgesic request made) and the total requirement of rescue analgesia for 24 Hours post-operative period.

Results : It was observed that the mean duration of analgesia in was 12.90 ± 1.94 hours in Group A, in comparison to group B where it was 11.38 ± 1.56 hours, which was significant statistically ($p<0.001$).Further, it was observed that total

requirement of rescue analgesia was lesser in group A as compared to group B.

Thus, the study concluded that Levobupivacaine provides better and longer lasting post-operative analgesia as compared to Ropivacaine when used in Adductor Canal Block for patients undergoing knee arthroscopic surgery.

Introduction

Arthroscopic knee surgeries are commonly performed as day care procedures. Postoperative pain is a significant consequence of total joint arthroplasty, that can affect early mobilization, joint range of motion, and length of stay[1].

Inadequate pain control leads to patient discomfort and decreased rehabilitation in post -operative period contributing to venous thromboembolism and cardiac events. Adequate control of pain is therefore paramount to a successful outcome and to patient satisfaction [1,2]. Generally postoperative analgesia was administered through intravenous opioids and NSAIDS [3]. Unfortunately, opioids can cause several side-effects including sedation, confusion, constipation, nausea, vomiting, and pruritus. Epidurals containing local anaesthetics with or without an opioid provide superior analgesia, but can cause severe hypotension, urinary retention, delayed ambulation, and there is a risk of developing an epidural hematoma with concomitant use of postoperative anticoagulation[4]. In addition to these direct medical issues, these side effects can have a significant financial impact and can increase overall costs due to delayed discharge and additional monitoring requirements.

As a result, other strategies like peripheral nerve blocks have been developed to achieve adequate pain control while attempting to minimize side effects of opioids and epidural anaesthesia. Peripheral nerve blocks are commonly used and efficient methods of providing perioperative analgesia.

Today, the advancement in nerve stimulation and ultrasound guidance has resulted in improved localization and overall block success[5].

Adductor canal block (ACB) is one such lower limb block which is commonly practised in patients undergoing knee arthroscopy surgeries and ACL repairs. Femoral nerve block(FNB) is also used for the same, but ACB being a pure sensory block, provides comparable analgesic efficacy and facilitates earlier mobilization by sparing quadriceps strength compared with FNB[6].

Various local anaesthetics have been used in the lower limb blocks such as Xylocaine, Ropivacaine, Bupivacaine and Levobupivacaine in different concentrations. Bupivacaine though commonly used in nerve blocks, carries a notorious side effect profile(mainly cardiotoxicity and CNS toxicity) if administered by intravenous route. Due to the nature of rich vascularity of adductor canal, inadvertent or accidental injections of bupivacaine can prove to be dangerous as life threatening complications can occur. However, drugs like Ropivacaine and Levobupivacaine are safer in this respect. Ropivacaine has been safely administered in various peripheral nerve block [7]. It has been shown that Ropivacaine is as efficacious as Bupivacaine with advantages of less cardiotoxicity and neurotoxicity and less motor blockade[8].Levobupivacaine is an enantiomer of Bupivacaine which doesn't carry the side effect profile of Bupivacaine. It is also seen to have longer duration of analgesia with minimal motor blockade. Clearly, both Ropivacaine and Levobupivacaine are safer options than Bupivacaine in PNB. Hence, we would like to base our study on this comparison [9,10].

Aims

To compare the analgesic efficacy of 0.5% Ropivacaine and 0.5% Levobupivacaine in ultrasound guided Adductor Canal Block (ACB)for patients undergoing knee arthroscopic surgery in terms of duration of analgesia and total requirement of rescue analgesic in both groups for first 24 hours after the block.

Materials and Methods

This randomized prospective study was conducted for a period of 18 month (Oct.2017- April 2019) in the Department of Anaesthesia and Intensive care ,VMMC and Safdarjung Hospital, New Delhi, after obtaining clearance from Hospital's Ethics Committee. Informed written consent was obtained from the patients.

The inclusion criteria included adult Patients aged between 18 and 65 years with ASA I/II physical status admitted for elective knee arthroscopic surgeries.

The exclusion criteria included patients with Allergy to amide group of local anaesthetic agent,. Significant neurological disease in lower limb, renal disease or psychiatric history And Patient on anticoagulants or known case of bleeding disorder.

Sample size was calculated on the base of the previous study by Mankad et al.[11]. To detect the difference of mean duration of analgesia as 25% (12.56 ± 1.30 h in the Levobupivacaine group & 9.93 ± 1.7 h in the Ropivacaine group) with level of significance 0.05(α); and power of the study being 85%, the minimum sample size required for the study was 90. Total 90 patients who met inclusion criteria were enrolled for the study which were randomized in two groups by taking 45 subjects in each group .Block Randomization with Sealed envelope system was used for randomization..

The subjects were divided into two groups:

Group A(N=45) Received Inj. Levobupivacaine (0.5%, 20 mL) in adductor canal block.

Group B(N=45) Recieved inj Ropivaivacaine (0.5% ,20 mL) in adductor canal block.

In the operation theatre routine monitors were attached to the patient and baseline vital parameters were noted.

The surgeries (ACL repair-Single or Double bundle) were carried out under subarachnoid block using 1.5ml of Bupivacaine(H) and 10mcg Fentanyl12. The adductor canal block (ACB) was Performed after completion of surgery.

After completion of surgery, patient was positioned with knee slightly flexed and leg externally rotated. Following proper sterile preparations with chlorhexidine 0.5%, ultrasound guided ACB was given. Adductor canal was identified by moving high frequency ultrasound transducer from proximal to distally, approximately at the mid-thigh level. At this point the saphenous nerve usually lies anterior to the femoral artery deep to Sartorius muscle.

Parallel to and in plane with the transducer, a 10cm 22 Gauge needle was inserted an anteromedial to posterolateral direction. With the tip of the needle located in the adductor canal close to the saphenous nerve 10ml of sodium chloride was injected to distend the canal. After confirming needle tip placement in adductor canal , 20ml of 0.5% local anaesthetics (Ropivacaine or Levobupivacaine) was injected.

In post anaesthetic recovery room patients were observed for the duration of post-operative analgesia and requirement of post-operative rescue analgesia. The time of ACB was considered 0 hour, thereafter pain was assessed by using a Visual Analogue Scale (VAS) scoring from zero (total absence of pain) to 10cm (the worst imaginable pain) at 4, 6, 8, 12 and at 24 hrs from the time of giving block[12]. On demand of the patient or VAS >4, Rescue analgesia in the form of Paracetamol 1gm IV infusion was given and noted. If

pain not relieved or VAS remain greater then 4,Inj Tramadol 50 mg IV. was administered and noted. Time elapsed between the ACB and the first rescue analgesic was considered the duration of analgesia of the block. The number of rescue analgesic injections received by the patient in 24 hrs were also noted. Both the groups were compared for duration of analgesia (time between the end of local anaesthetic administration and the first analgesic request made) and the total requirement of rescue analgesia for 24 hrs post-operative period. .Any side effect or complications were documented. Monitoring of vital parameters – heart rate, blood pressure, respiratory rate, SpO2 was done during study period.

The data was analysis using Statistical Package for Social Sciences (SPSS) version 21.0. Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then non parametric test was used.

Quantitative variables were compared using Unpaired t-test/Mann-Whitney Test (when the data sets were not normally distributed) between the two groups. Qualitative variables were correlated using Chi-Square test /Fisher's exact test.

A p value of <0.05 was considered statistically significant.

Results

Table 1: Demographic profile and surgical indication of patients.

	Group A N=45	Group B N=45	P value
Mean AGE (YRS)	26.67 ± 5.64	26.76 ± 5.3	0.939
Gender F/M (%)	24.4/75.6	17.8/82.2	0.438
ASA grade 1/2 (%)	91.1/8.9	91.1/8.9	1.000
Surgical indication DB ACL Tear/SB ACL Tear (%)	35.6/64.4	44.4/55.6	0.389

Table 1 shows that The mean age, gender distribution, and ASA grading of patients are comparable in both the groups. Study groups also comparable in terms surgical indication.

Table 2: Duration of Surgery and Duration of analgesia of block

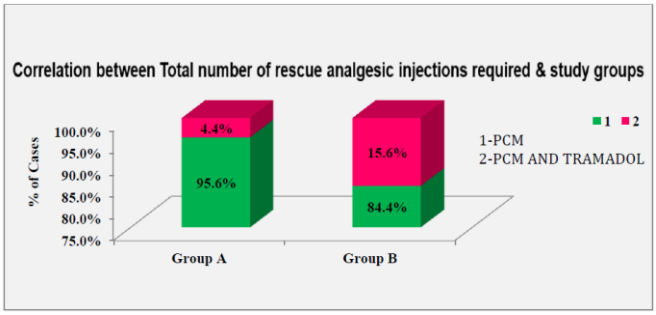
	Group A	Group B	P value
Duration of surgery(Min) mean± SD	66.67 ±8.98	68.44±9.89	0.373
Duration of analgesia of Block (Hrs) mean ±SD	12.9±1.94	11.38±1.56	<0.001 *

Table.2 It was observed that the mean duration of surgery of the patients in group A was 66.67 ± 8.98 minutes while for group B,it was 68.44 ± 9.82 minutes(p = 0.373). It was observed that the mean duration of analgesia of block was 12.90 ± 1.94 hours in group A, while for group B,it was 11.38 ± 1.56 hours. Further, it was observed that there was a significant*difference in duration of block between the two groups (p <0.001).

Table 3: Requirement of rescue analgesic

Rescue analgesic required	Group A	Group B	P value
1 PCM	95.6%	84.4%	0.157
2 PCM and Tramadol	4.4%	15.6%	0.156

Figure 1



As in Figure1 and Table-3, there was requirement of only one rescue analgesia in 95.6% of patients in Group A as compared to 84.4% in group B (p =0.157).

It was also observed that only 2 patients in group A required second rescue analgesia (inj Tramadol 50mg iv) as compared to 7 in group B. The total dose of Tramadol was 100mg in Group A in comparison to 350mg in Group B. (p = 0.156).

No complication was observed in any patient of both the groups.

Discussion

Majority of knee arthroscopic surgeries are done for musculoskeletal injuries (eg. Meniscal tear, ACL tear).Pain relief is of prime concern in such patients to enable early ambulation thereby shortening the post-operative stay which eventually decreases the overall morbidity. There are several methods of providing analgesia for these patients including femoral nerve block but Adductor Canal Block is an upcoming technique of providing analgesia in the same group of patients. Several studies have concluded its advantage over Femoral Nerve Block in terms of early ambulation. In ACB, the saphenous nerve is mainly blocked (pure sensory branch of femoral nerve), thus sparing quadriceps muscle strength and providing early ambulation. Various local anaesthetics have been used for peripheral nerve blocks including Lignocaine, Mepivacaine, Bupivacaine and its S-enantiomers: Levobupivacaine and Ropivacaine. Considering the side effect profile of Bupivacaine in cases of accidental intravenous injections, we included the two S-enantiomers i.e. Levobupivacaine and Ropivacaine in the study and compared them with respect to the duration of analgesia, total requirement of rescue analgesia and VAS scores, when administered in Adductor Canal Block for patients undergoing knee arthroscopic surgery.

The demographic profile of study patients in both the groups, were comparable in terms of age, sex, and ASA grading.

In our study, the results showed that Adductor Canal Block performed using 20ml of 0.5% Levobupivacaine provides longer analgesia (12.9 ±1.94 Minutes)in comparison to the same dose of Ropivacaine; with less requirement of rescue analgesia in the former group .

Roxane Fournier et al, compared 0.5% of Levobupivacaine and Ropivacaine in Sciatic nerve block for patients undergoing foot and ankle surgery and concluded Levobupivacaine provided better analgesia compared to ropivacaine group [13]. These results were parallel to our study.

Casati et al. conducted a randomized double blind trial using the same dose of (20ml of 0.5% of Levobupivacaine and 20ml of 0.5% Ropivacaine) as in our study in posterior sciatic nerve block for hallus valgus repair in 50 patients. However, they found similar analgesic duration (around 16 hours) in both the groups [14].

In contrast of our study, Santorsola et al. compared 20ml of 0.5% each of Levobupivacaine, Ropivacaine and Bupivacaine in Hallus valgus patients in Sciatic nerve block and did not find any clinically relevant differences in the duration of action in any of the groups [15].

Compared to our study, Cline et al. described 3 hours of prolonged analgesia with 40ml of 0.5% Levobupivacaine compared with 40ml of 0.5% Ropivacaine in axillary brachial plexus block. They used twice the dose but the duration of analgesia did not increase that much; they concluded that the duration of block also varies with various regional techniques[16].

Cacciapuoti et al found that the duration of analgesia with Levobupivacaine 0.5% (1mg/kg) was 3.5 hours more than that of Ropivacaine 0.5% (1.5mg/kg)[17].

The reason for longer analgesia with Levobupivacaine over Ropivacaine could be based on the molecular weight of Levobupivacaine and Ropivacaine; there is a difference in their molarity. Besides, they exist as a

base and hydrochloride salt respectively.The concentration of levobupivacaine is expressed as mg/mL of base, whereas ropivacaine is expressed as mg/mL of hydrochloride salt. One mole of ropivacaine has a mass of 274 g and one mole of levobupivacaine has a mass of 288 g. The molecular weight of hydrogen chloride accounts for 36.46 g. Therefore, taking molar weights into consideration, a concentration of levobupivacaine expressed as mg/mL has 7% to 8% more active molecules than ropivacaine[18].

It is also important to note that the duration of block was related to plasma protein binding of the drug, and more highly protein-bound drugs have a longer duration of action. Percentage of protein binding differs slightly but not significantly in both groups (94% in Ropivacaine versus 95% in levobupivacaine)[19].

It is of importance to note that the type of block may also have an influence on the potency ratio between these two drugs, because clinical equipotency has mainly been demonstrated in patients undergoing epidural analgesia [20].

Roxane Fournier et al,[13] also found that consumption of Inj. Morphine at 24 hrs was reduced markedly in Levobupivacaine group (6 ±11 mg in 24 hrs) as compared to Ropivacaine group (15 ± 11 mg in 24 hrs) with $p<0.04$. These results are not akin to our study which showed comparable requirement of total analgesia in Levobupivacaine group and Ropivacaine group i.e. 4.4% patients in Levobupivacaine group compared to 15.6% in ropivacaine required more than one rescue analgesia and this result was statistically insignificant ($p =0.156$).

Li, Ang et al. conducted a meta-analysis of twelve Randomised Controlled Trials comparing Ropivacaine and Levobupivacaine and found that the Levobupivacaine provided more long term anaesthesia with significantly lower incidence of postoperative rescue analgesic requirement than Ropivacaine group[21].

Thus, in our study Levobupivacaine provided better and longer duration of analgesia with lesser rescue analgesic consumption as compared to Ropivacaine, when used in ACB for patients undergoing knee arthroscopic surgery.

Limitations

It is a single centred study. More studies based in multiple centres, involving larger number of patients are required for the class I evidence.

References

1. Drosos GI, Stavropoulos NI, Katsis A, Kesidis K, Kazakos K, Verettas DA.Postoperative pain after knee arthroscopy and related factors. Open Orthop J.2008;2:110-114.
2. Slover J, Reisgo A , Payne A, Umeh U. Modern Anaesthesia For Total Joint Arthroplasty. Ann Orthop Rheumatal.2014; 2:1026.
3. Mazzone M, Siciliano M, Carella G. Multiple diclofenac-induced adverse effect.Am J Gastroenterol. 2000;95:2988-89.
4. Parnass M, Schmidt K J. Adverse effects of spinal and epidural analgesia. Drug Saf. 1990;5:179-94.
5. Abrahams MS, Aziz MF, Fu RF, Horn JL. Ultrasound guidance compared with electrical neurostimulation for peripheral nerve block: a systematic review and meta- analysis of randomized controlled trials. Br J Anaesth.2009;102:408-17.
6. Koh IJ, Choi YJ, Kim MS, Koh HJ, Kang MS, In Y. Femoral Nerve Block versus Adductor Canal Block for Analgesia after Total Knee Arthroplasty. Knee Surgery& Related Research. 2017;29:87-95.

7. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. Indian Journal of Anaesthesia. 2011;55:104-10.
8. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. Indian Journal of Anaesthesia. 2011;55:104-10.
9. Bajwa Sukhwinder, Kaur Jasleen. Clinical profile of Levobupivacaine in regional anaesthesia: A systematic review. J Anesthesiol Clin Pharmacol.2013;29:530-9.
10. Iamaroon A, Tangwiwat S, Srivanasandha B, Halilamlen P, Lertpnmetha Y, Sirimaneewattana. Femoral Nerve Block using 0.25% or 0.5% Bupivacaine for analgesia after arthroscopic anterior cruciate ligament reconstruction. J Med AssocThai. 2014;97:717-23.
11. Mankad P P, Makwana JC, Shah B J. A comparative study of 0.5% ropivacaine and 0.5%levobupivacaine in supraclavicular brachial plexus block. Int J Med Sci. 2016;5:74-79.
12. Carol A Bodian, F Gordon, H Sabera, B James, Eisenkraft, B Yaakov. The Visual Analog Scale for Pain: Clinical Significance in postoperative Patients. Anesthesiology. 2001;95:1356-61
13. Fournier Roxane MD; Faust, Alexandre, MD; Chassot, Olivier, MD; Gamulin, Zdravko, MD. Levobupivacaine 0.5% Provides Longer Analgesia After Sciatic Nerve Block Using the Labat Approach than the same dose of Ropivacine in foot and Ankle surgery.Anesth Analg.2010;110:1486-89
14. Casati A, Borghi B, Fanelli G, Cerchierini E, Santorsola R, Sassoli V, Grispigni C, Torri G. A double-blinded, randomized comparison of either 0.5% levobupivacaine or 0.5% ropivacaine for sciatic nerve block. Anesth Analg 2002;94:987–90.
15. Santorsola R, Casati A, Cerchierini E, Moizo E, Fanelli G. Levobupivacaine for peripheral blocks of the lower limb: a clinical comparison with bupivacaine and ropivacaine. Minerva Anestesiol. 2001;67:33–6.
16. Cline E, Franz D, Polley RD, Maye J, Burkard J, Pellegrini J. Analgesia and effectiveness of levobupivacaine compared with ropivacaine in patients undergoing an axillary brachial plexus block. AANA J 2004;72:339–45.han the Same Dose of Ropivacaine in Foot and Ankle Surgery. Aesth Analg: 2010;110:1486-89.
17. Cacciapuoti A, Castello G, Francesco A. Levobupivacaina, bupivacaina racemica e ropivacaina nel blocco del plesso brachiale. Minerva Anestesiol. 2002;68:599–605.
18. McLeod GA, Columb MO. Moles, weights and potencies:freedom of expression! Br J Anaesth. 2005;95:110–11
19. Leone S, Di Cianni S, Casati A, Fanelli G. Pharmacology, toxicology, and clinical use of new long acting local anesthetics, ropivacaine and levobupivacaine. Acta Biomed. 2008;79:92–105.
20. Dan Benhamou, Caroline Ghosh, Frédéric J. Mercier. A Randomized Sequential Allocation Study to Determine the Minimum Effective Analgesic Concentration of Levobupivacaine and Ropivacaine in Patients Receiving Epidural Analgesia for Labor. Anesthesiology. 2003;99:1383-6.
21. Li Ang, Wei Zhijian, Liu Yang, Shi Jiaxiao, Ding Han, Tang Haushuai et al. Ropivacaine versus Levobupivacaine in peripheral nerve block A PRISMA-compliant meta-analysis of randomised controlled trials. Medicine. 2017;96:1-8.