A COMPARISON BETWEEN FEMORAL NERVE BLOCK AND LOCAL INFILTRATION ANALGESIA WITH ROPIVACAINE: A PROSPECTIVE, COMPARATIVE AND OBSERVATIONAL STUDY

Anesthesiology

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ABSTRACT

Background: postoperative pain is a type of acute pain in the immediate postoperative period which has both pathophysiological and therapeutic point of view. Different drugs through different routes are being used for relief of postoperative pain. we have analysed the efficacy of two different routes via femoral nerve block and local infiltration of ropivacaine for post-arthroscopic pain relief.

Materials and methods: we have conducted the study from November 2017 to March 2018. 60 patients undergoing arthroscopic anterior cruciate ligament reconstruction surgery were randomly assigned into two groups; in a double blinded manner (group 1 and group 2). Group 1 received 0.2% of 20ml ropivacaine for blocking the femoral nerve of the affected limb whereas group 2 received the same drug through local infiltration of wound edges and subcutaneous plane. Pain was assessed using visual analogue scale (VAS) and rescue analgesia with 75mg injection diclofenac was given on demand when VAS score is >4 and number of times injection diclofenac was given in the 24 hours postoperative period.

Analysis: demographic variables were quite comparable between the groups. The mean number of times of rescue analgesia was high in group 2 (2.9333 ± 0.9444) than group 1 whose mean number of rescue analgesia was 1.4667 ± 0.7761 and difference of mean was statistically significant ($p < 0.0001$).

Conclusion: compared with local infiltration of ropivacaine femoral nerve block with ropivacaine provides better analgesia after ACL reconstruction with lesser diclofenac consumption and lower VAS score.

KEYWORDS

Femoral Nerve Block, Local Infiltration Analgesia With Ropivacaine

INTRODUCTION

Anterior cruciate ligament (ACL) reconstruction is now mainly performed on an outpatient basis. The postoperative period of ACL reconstruction can be painful and may impair early mobilization and increase duration of hospital stay, if proper postoperative analgesic techniques are not employed. Potent analgesics such as opioids may be administered but it is associated with respiratory depression, excessive sedation, nausea and vomiting prolonging hospital stay. Femoral nerve block has been successfully used for postoperative pain relief after knee surgeries. But it is associated with variable degree of paralysis of thigh flexor muscles especially quadriceps which may delay ambulation in the postoperative period.¹ Several other techniques like intra-articular injection of morphine, local infiltration of local anesthetics and sciatic nerve block has been used for postoperative analgesia. But both local infiltration of local anesthetics and femoral nerve block are easy, inexpensive and can be done in combination with spinal or general anesthesia. Many authors consider femoral nerve block or blockade of distal femoral nerve distribution to be the best available analgesic option after ACL reconstruction. This technique relies on depositing the local anesthetic in the vicinity of femoral nerve. The sensory distribution of this nerve is mainly responsible for pain after knee surgery. An alternative approach is local infiltration of local anesthetics in the surgical site which was developed more than 40 years ago. The simplicity of the technique and absence of motor weakness with it is the reason of widespread use of this technique among orthopedic surgeon. A systemic review which was limited to qualitative assessment of previously concluded that both analgesic approaches were equivalent.² Ropivacaine is an amino-amide local anesthetic which causes reversible inhibition of sodium ion influx and thereby blocks the impulse conduction in nerve fibres. This action is potentiated by dose-dependent inhibition of potassium channel. Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor nerve fibres. Therefore it has selective action on pain transmitting A β and C fibres rather than A δ fibres which are involved in motor function.³

MATERIAL AND METHODS

The study is a prospective, comparative and observational study. It was approved by the institutional ethics committee. ASA physical status I and II, aged between 18 to 60 years of both sexes were included in the study, who were undergoing anterior cruciate ligament reconstruction

by knee arthroscopy under general anesthesia. Selected patients ($N=60$) are randomly allocated into two groups (30 in each group). Patients in group I received 20ml of 0.2% of ropivacaine through femoral nerve block. Patients in group II received 20ml of 0.2% ropivacaine through local infiltration in wound edges and subcutaneous plane along incision line before wound closure intraoperatively. Exclusion criteria: Patient refuses to give consent ASA III/IV Patient on sedation medication/opioids/antidepressant h/o alcohol intake h/o daily analgesic intake uncontrolled medical disease renal/ hepatic dysfunction known coagulopathy seizure disorder hypersensitivity to any drug ischaemic heart disease h/o intake of NSAIDs within 24 hours. In the preoperative assessment, patient was enquired about any previous surgery, drug allergy, any prolonged drug treatment. General and systemic examination was done together with airway assessment. Preoperative 6 hours fasting was ensured before surgery. All patients were given premedication with 0.25mg alprazolam before surgery as per preanesthetic checkup direction to allay anxiety, apprehension and for sound sleep. Patients also received tablet ranitidine 150mg the night before surgery and the day of surgery. All patients were clinically examined in the preoperative period and the whole procedure was explained in details in local language and written consent was obtained. A 10cm visual analogue scale (0: no pain, 10: worst pain) was explained in the preoperative visit. Preoperative hematological parameter like Hb%, TC, DC, ESR, platelet count, blood sugar, blood urea, creatinine and liver function test was done. A 12-lead ECG and chest x-ray was also done. After patient is placed on the operative table, standard intraoperative monitors like ECG, NIBP, pulse oximeter, capnography was attached and baseline parameters were recorded. Phillips IntelliVue MP20 monitor was used for this purpose. The anesthetic procedure was standardized for all patients. General anesthesia was given followed by endotracheal intubation with propofol, fentanyl and succinylcholine and premedication with ondansetron and glycopyrrolate. Then maintenance was done with vecuronium and desflurane. Intraoperatively patient received infusion paracetamol 1gm i.v. In group I patient after reversal from general anesthesia femoral nerve of the operated limb is blocked with 20ml of 0.2% ropivacaine using a peripheral nerve stimulator. In group 2 patient before wound closure 20ml of 0.2% ropivacaine was infiltrated along wound edges and subcutaneous plane along incision line, then after wound closure patient was reversed from general anesthesia with neostigmine and glycopyrrolate. Tourniquet was kept inflated for

another 20 minutes. Drain put by the surgeon was clamped before administering the drug and retained clamped for another 20 minutes. Heart rate, non-invasive blood pressure, respiratory rate, ECG and vas score was recorded at 0, 2, 4, 8, 12 and 24th postoperative hour. Injection diclofenac sodium (75mg I.M) was given as rescue analgesia if the vas score was >4 . Total number of times diclofenac injection was consumed in 24 hours was calculated. All data was collected by an observer who is unaware of the patient group assignment. Statistical analysis: For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 24.0; SPSS Inc. Chicago IL, USA) and GraphPad Prism version 5. Data has been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two sample t-test for a difference in mean involved independent samples or unpaired samples. Paired t-tests were a form of blocking and had greater power than unpaired test. Explicit expressions that can be used to carry out any various t-tests are given. In each case, the formula for a test statistics that either exactly follows or closely approximate a t-distribution under the null – hypothesis is given. Also appropriate degree of freedom is given in each case. Each of these statistics can be used to carry out either a one tailed test or a two-tailed test. Once a t-value is determined p-value can be found using a table of values from student t distribution. If the calculated p-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05 or 0.01 level), then null hypothesis is rejected in favor of alternative hypothesis. p-value ≤ 0.001 is considered statistically significant.

RESULTS AND ANALYSIS

We found that difference of mean age vs. group was not statistically significant ($p=0.9430$). Difference of mean weight vs. group was not statistically significant ($p=0.2670$). Difference of mean height vs. group was not statistically significant ($p=0.9225$). Difference of mean SPO₂ was not statistically significant in group during time interval. In group-1 (FNB), 2(6.7%) patients had female and 28(93.3%) patients had male. In group-2 (LIA), 1(3.3%) patient had female and 29(96.7%) patients had male. Association of sex vs. group was not statistically significant ($p=0.5536$). We found that In group-1 (FNB) the mean value of VAS at 0 hr was significantly higher than group-2 (LIA) and difference of mean VAS at 0 hr in two groups was statistically significant ($p=0.0004$). In group-1 (FNB) the mean value of VAS at 1 hr was significantly higher than group-2 (LIA) and difference of mean VAS at 1 hr in two groups was statistically significant ($p=0.0323$). In group-1 (FNB) the mean value of VAS at 2 hr was significantly higher than group-2 (LIA) and difference of mean VAS at 2 hr in two groups was statistically significant ($p<0.0001$). In group-1 (FNB), the mean No of times inj Diclofenac (mean $\pm$ s.d.) of patients was $1.4667 \pm .7761$. In group-2 (LIA), the mean No of times inj Diclofenac (mean $\pm$ s.d.) of patients was $2.9333 \pm .9444$. Difference of mean No of times inj Diclofenac vs. group was statistically significant ($p<0.0000$). In group-1 (FNB) the mean value of VAS at 0 hr was significantly higher than group-2 (LIA) and difference of mean VAS at 0 hr in two groups was statistically significant ($p=0.0004$). In group-1 (FNB) the mean value of VAS at 1 hr was significantly higher than group-2 (LIA) and difference of mean VAS at 1 hr in two groups was statistically significant ($p=0.0323$). In group-1 (FNB) the mean value of VAS at 2 hr was significantly higher than group-2 (LIA) and difference of mean VAS at 2 hr in two groups was statistically significant ($p=0.3623$).

DISCUSSION

Day care surgery is proven to be the best to decrease the burden on health care services and in achieving patient satisfaction.

In countries like India where health care resources are limited day care procedure are an effective way of reducing the burden on health care services but limitation of movement and pain limits early mobilization and early discharge so procedures to reduce pain improve early ambulation helps in easing the burden on healthcare services.⁴

Arthroscopic repair has variable pain associated with it. Femoral nerve block is newer modality used for postoperative analgesia. Local infiltration of local anesthetic in wound is an age old way of providing postoperative analgesia.

In our prospective and comparative study we have compared the analgesic efficacy of two modalities using similar drug following arthroscopic knee repair.

Ropivacaine is structurally closely similar to bupivacaine, the

difference being a propyl group instead of a butyl group. ropivacaine is supplied in a pure S-enantiomer form and has less lipid solubility, differential blockade and lesser systemic side effects.⁵

Femoral nerve block provides better analgesia compared to local infiltration of ropivacaine but is associated with muscle weakness and consequent delayed ambulation.

In a study conducted by Kirkham KR⁶ (2017) found that intermediate and late postoperative periods were significantly lower in patients who received a femoral nerve block, with mean differences (95%CI) of 1.6 (0.2–2.9), $p=0.02$; 1.2 (0.4–1.5), $p=0.002$; and 0.7 (0.1–1.4), $p=0.03$ respectively. The quality of evidence for our primary outcomes was moderate to high. Regarding functional outcomes, only one trial reported a similar range of motion between groups at 48 postoperative hours. No trial sought to record complications. In conclusion, femoral nerve block provides superior postoperative analgesia after anterior cruciate ligament reconstruction to local infiltration analgesia.⁷

In our study demographic variables were similar in both groups and were not statistically significant.⁸

The VAS score was lower in the group 1 which received femoral nerve block with ropivacaine (1.4333 ± 0.6261) then group 2 (2.3333 ± 0.4795) at 4th postoperative hour.⁹ anesthetic, femoral nerve block (FNB) provides better analgesia and allows a significant Iskandar H et al¹⁰ (2003) found that VAS score in the recovery room and during rehabilitation was higher in the intra-articular group than in the femoral group ($P<0.001$). Morphine use was lower in the femoral group than in the intra-articular group ($P<0.001$). Similarly, analgesic duration was longer in the femoral group than the intra-articular group ($P<0.0001$). Compared with intra-articular injection of local morphine-sparing effect after ACL repair.

In our study we found that In group-1 (FNB), the mean No of times injection Diclofenac (mean $\pm$ s.d.) of patients was $1.4667 \pm .7761$. In group-2 (LIA), the mean No of times injection Diclofenac (mean $\pm$ s.d.) of patients was $2.9333 \pm .9444$. Difference of mean No of times injection Diclofenac vs. group was statistically significant ($p<0.0001$). No side-effects were found among the groups.

A limitation of our study is that we did not follow-up the patients whether any local tissue damage occurred or not due to block and the drug.¹¹

CONCLUSION

Compared with local infiltration of ropivacaine, femoral nerve block (FNB) provides better analgesia after ACL reconstruction.

Analgesia was more effective with femoral nerve block, which allowed better control of postoperative pain, as assessed during the time interval.

The diclofenac consumption during the initial 24 hours was significantly lower in the group 1(FNB) group. The patients treated with femoral nerve block had significantly better pain scores and lower diclofenac consumption than those treated with local infiltration of anaesthetic.

Femoral nerve block for ACL reconstruction with ropivacaine provided better post-operative analgesia than local infiltration of ropivacaine.

Figure: Distribution of mean No of times inj Diclofenac : Group

In group-1 (FNB), the mean No of times inj Diclofenac (mean $\pm$ s.d.) of patients was $1.4667 \pm .7761$. In group-2 (LIA), the mean No of times inj Diclofenac (mean $\pm$ s.d.) of patients was $2.9333 \pm .9444$. Difference of mean No of times inj Diclofenac vs. group was statistically significant ($p<0.0001$).

Table: Distribution of mean VAS at different time of interval in two groups

		Number	Mean	SD	Minimum	Maximum	Median	p-value
VAS at 0 hr	Group-1 (FNB)	30	.4000	.4983	0.0000	1.0000	0.0000	0.0004
	Group-2 (LIA)	30	.0333	.1826	0.0000	1.0000	0.0000	
VAS at 1 hr	Group-1 (FNB)	30	.5000	.5085	0.0000	1.0000	0.5000	0.0323
	Group-2 (LIA)	30	.2333	.4302	0.0000	1.0000	0.0000	
VAS at 2 hr	Group-1 (FNB)	30	.8000	.4068	0.0000	1.0000	1.0000	<0.0001
	Group-2 (LIA)	30	1.4333	.6261	0.0000	3.0000	1.0000	
VAS at 4 hr	Group-1 (FNB)	30	1.4333	.6261	1.0000	3.0000	1.0000	<0.0001
	Group-2 (LIA)	30	2.3333	.4795	2.0000	3.0000	2.0000	
VAS at 8 hr	Group-1 (FNB)	30	2.0033	.8503	1.0000	4.0000	2.0000	<0.0001
	Group-2 (LIA)	30	2.8667	.7184	1.0000	4.0000	2.0000	
VAS at 12 hr	Group-1 (FNB)	30	2.4333	.9714	1.0000	5.0000	2.0000	0.0004
	Group-2 (LIA)	30	3.4333	1.1043	2.0000	5.0000	3.0000	
VAS at 24 hr	Group-1 (FNB)	30	3.2000	.8469	2.0000	5.0000	3.0000	0.3623
	Group-2 (LIA)	30	3.4333	1.1043	2.0000	5.0000	3.0000	

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