International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2015): 6.391

Comparative Study of Postoperative Analgesia by Spinal Anaesthesia Alone v/s Spinal Anaesthesia with Femoral Nerve Block with 0.5% Bupivacaine in Arthroscopic Anterior Cruciate Ligament Reconstruction

P.S. Lamba[1], Pooja Meena[2], Puneet Panwar[3]

[1]Professor, Department of Anesthesiology, S.M.S. Medical College and Attached Hospitals, Jaipur

[2] Resident doctor, Department of Anesthesiology, S.M.S. Medical College and Attached Hospitals, Jaipur

[3] Resident doctor, Department of Anesthesiology, S.M.S. Medical College and Attached Hospitals, Jaipur

Abstract: ***Objectives: primary objective of this study was to evaluate postoperative analgesia in patients undergoing ACLR with spinal anaesthesia alone or combined with FNB and the secondary objectives were to assess thefirst analgesics request in the postoperative period in 2 group and adverse events. Method: 70 patients were randomly divided into 2 groups GA (n =35) received spinal anesthesia and GB (n = 35) received spinal anesthesia and FNB. Results: There was no difference between both groups regarding demographic, clinical and surgical variables. Mean pain scores were higher at 10 hours in GA; At 10 hrs in group A (total 35 patients) 21(60%) patients had moderate pain, 13 (37%) patients had severe pain and 1(3%) patient felt mild pain while in group B(total 35 patients) 2(5.7%) patients had no pain, 22(62.8%) patients had mild pain, 8(22.9%) patients had moderate pain and 3(8.6%) had severe pain. Mean time for analgesic request in group A is 6.77±1.37 hrs and 10.91±1.93 hrs in group B. There were no serious adverse event except quadriceps muscle weakness. Conclusion: in this study it is concluded that postoperative analgesia for ACLR was more effective with combination of spinal anaesthesia + FNB as compared to spinal anaesthesia alone.***

Keywords: Postoperative analgesia, femoral nerve block,Anterior cruciate ligament reconstruction, Spinal anesthesia, Adverse event

1. Introduction

ACLR often results in significant pain. The intra-articular structures of the knee including the anterior synovial tissues, fat pad, and joint capsule are sensitive to painful stimuli and can produce severe pain[1].For postoperative analgesia in ACLR we can use opioids but they may increase the incidence of respiratory depression, excessive sedation, nausea and vomiting, leading to increased length of stay and hospital cost.

Beside pain control technique early ambulation and cost reduction is also needed for ACLR surgery. Though FNB provide excellent analgesia but have transient decrease in quadriceps muscle power so patient may fall during walk [2] [3]FNB also reduce need of opioids [4] [5][6][7].it is easy to perform, inexpensive, and may be done in combination with general or spinal anaesthesia [8][9]. FNBs can be performed as a single shot or as a continuous block using a catheter and an infusion. It also avoids the risk of epidural hematoma that is associated with the use of anticoagulants simultaneously with epidural analgesia [13] [14].

Several studies shows for pain treatment in ACLR and total knee arthroplasty FNB is very useful in postoperative analgesia [4][5] however it could even be related to complications such as infection, hematoma, and transient weakness of the thigh flexor muscles in early post-operative period[10][12].

The primary objective of this present prospective randomized study was to evaluate postoperative pain in patients undergoing ACLR with spinal anaesthesia alone v/sspinal combined with FNB. Other objectives were to assess first rescue analgesics request in the postoperative period and adverse related to the techniques.

2. Material And Method

Present study was Hospital – based, prospective, randomized, interventional study conducted in the Department of Anesthesiology, S.M.S Medical College and attached group of hospitals, Jaipur with due permission from the institutional ethical committee and review board and after taking written informed consent from the patients.

In this study we included 70 patients of ACL tear who went under arthroscopic ACL reconstruction. Inclusion criteria were ASA grade I and II, Patients willing to give written informed consent, Patients of either sex, Age Groups 18 to 65 years, Weighing 45 to 110 kg, BMI between 18.5 to 40 kg.m–2 ,Height 145 to 190cm, Not allergic to study drug. We excluded the uncooperative patients, ASA Grade III and IV, who had any deformity or local sepsis in spinal lumbar region, who had any bleeding or coagulation abnormalities and pt. on anticoagulants, on tranquilizers, phenothiazine, or other CNS depressants (including alcohol), who had any major pre-existing neurological, cardiovascular, metabolic, hepatic, respiratory or renal disease, history of allergy or

hypersensitivity to any of the study drugs or concurrently being treated for nausea or vomiting,Pregnant women**,** Emergency surgery or ACL reoperation.
Patient was randomly allocated into two groups of 35 patients each. Randomization was done by chit in box method, a total of 70 chits (35 per group) was made, and each chit was mentioned a particular study group. One of my colleagues was ask the patient to pick up a chit from the box. Patient was allocated to group mentioned on the chit.

- Group A(n=35) - Patients was received subarachnoid block with injection bupivacaine heavy (0.5%) 3ml
- Group B(n=35) - Patients was received subarachnoid block with injection bupivacaine heavy (0.5%) 3 ml and femoral nerve block with injection bupivacaine (0.5%) 20 ml

All patients was visited one day prior to surgery and explained about the anaesthetic technique. Each patient had a pre-anaesthetic checkup which includes:Any significant present/past medical/surgical history. General physical examination, systemic examination, Vital parameters B.P./Pulse/Respiratory rate/Temp/height/weight, Any history of drug allergy, ASA status, Routine investigation – Hematological(CBC, TLC, DLC, Bleeding time, Clotting time), Fasting/random blood sugar, RFT-Serum Urea and Creatinine, Serum electrolytes, LFT- serum bilirubin, SGOT, SGPT, Chest x ray.

After taking written informed consent and confirming overnight fasting, patients were taken on the operation table. Baseline vitals like B.P., pulse rate, respiratory rate were recorded. After securing an 18G i.v. cannula, ringer lactate solution was started in all patients before performing subarachnoid block.Under strict aseptic conditions, spinal anesthesia was performed at L3-L4 interspace (L4-L5 in case of failure) with the patient in sitting position by using a 25 Gauge Quincke needle. Free flow of cerebrospinal fluid was verified before injection of the anesthetic solution and inj. Bupivacaine 0.5% (heavy) 15mg (3ml) administered over 30 seconds at the rate of 0.2ml/second. Patients were immediately placed in the supine position without tilting the operating table. Anaesthesia was considered satisfactory when there is loss of cold sensitivity from lower limbs to the umbilicus, test with an alcohol swab. Monitoring was done using continous electrocardiography, non-invasive blood pressure and continous pulse oximetry and patients were given 4.0 L/min of oxygen by venti-mask.

FNB was performed only in GroupB patients. After antisepsis and sterile surgical field placement, the needle inserted at the midpoint of the line joining the anterior superior iliac spine to the pubic tubercle, lateral to the pulse of the femoral artery, below the inguinal ligament and at the inguinal crease level. Appropriate neurostimulator needle (22G x 2", 0.7) connected to the electrical neurostiulator , initially programme with 2 Hz frequency and 1.0 mA electric current to cause contraction of the femoral quadriceps muscle, evidence by patella elevation. After identifying the correct needle placement, determined by the persistence of muscle contraction by reducing the stimulation between 0.6 and 0.2 mA, 0.5% bupivacaine (100 mg) administered without vasoconstrictor.Intraoperative fluid management was done according to the blood loss and hemodynamic parameters.

Intraoperative we monitored pulse rate, NIBP, ECG and SPO2. The level of sensory block was tested by pin prick bilaterally at mid-clavicular line which was done every two minute till the T10 dermatomal level was achieved. Onset of motor block was taken as the time taken to achieve modified Bromage score 1 from the time of subarachnoid injection. Hypotension considered if (MAP < 70mm Hg) and treated by incremental doses of ephedrine 5mg IV and IV fluid as required. Bradycardia (Pulse rate < 50/min) treated with incremental doses of atropine 0.3–0.6 mg IV. Respiratory depression (SPO2< 90%) treated with 100% oxygen. Nausea and vomiting treated with Inj. Ondansetron 4mg.

At discharge to the ward, all patients received a card with the Visual analog pain Scale (VAS). Pain intensity assessments VAS in which "0" means no pain and "10" the worst pain possible. Pulse Rate, NIBP, saturation were recorded at regular interval of 2hrs till 12 hrs then at 24 hr. Postoperatively Pulse Rate, NIBP, saturation were recorded at regular interval of 2hrs till 12 hrs then at 24 hr.

All patients were told that if the pain score equal to or Greater than 4, they could request the analgesic at any time. Termination of motor blockade due to spinal anaesthesia was assesses by BROMAGE SCALE. Effect was assessed in non-operated limb.

Patients were monitored for postoperative side effects as PONV, FNB local pain, Respiratory depression, Weakness of quadriceps muscle and Cold sensation in lower limb.

3. Result

All the data entered onto a microsoft excel spreadsheet and analysed statistically using appropriate tests. A p-value of less than 0.05 (or 5%) was considered statistically significant. According to a previous statistical study, the sample size of 35 patients in each group would be required to identify a significant difference of two groups, with a probability of type-I error equal to 0.05 and 80% power.

Demographic Characteristics

Data	*Group A*	*Group B*	*P Value*
Gender			0.136
Male	33	29	
Female	2	6	
Age (years)	27.66±8.65	26.71±6.89	0.615
Height(cm)	171.03±4.35	169.91±6.52	0.403
Weight(kg)	67.31±6.97	64.63±8.07	0.140

Cm- centimeter, kg-kilogram

Data	*Group A*	*Group B*	*P Value*
ASA GRADE			0.400
Grade 1	31	33	
Grade 2	4	2	
SITE OF SURGERY			0.808
RIGHT	15	14	
LEFT	20	21	

There was no significant differerence regarding age, weight, sex and height of the patients in both groups.

Clinical and Surgical Characterstics:
ASA- American society of anesthesiologist classification

In our study both groups were homogenous in terms of ASA grading and side of surgery.

VAS SCORE: Regarding postoperative pain intensity, patients in groups A and B were compared between the evaluated times and this comparison between each time showed statistically significant difference between groups till 10hrs. After 10 hr there was no significant difference seen in both groups regarding pain score.

	Group A (Mean±SD)	*Group B (Mean±SD)*	*P value*
120 minutes	0	0	-
4 hrs.	2.51±1.01	0.06±0.24	p<0.001
6 hrs.	4.91±1.22	0.43±1.09	p<0.001
8 hrs.	6.43±1.01	1.00±1.89	p<0.001
10 hrs.	6.97±0.86	3.00±2.00	p<0.001
12 hrs.	6.97±0.86	6.26±1.09	0.053
24 hrs.	4.57±1.04	4.49±1.15	0.743

Pain stratified at 10 hrs after spinal anaesthesia:-In this study In the time interval of 10 hours after anaesthesia, more than half of the Group B patients had mild pain, unlike Group A that did not undergo such blockage, in which more than half of the patients reported moderate pain.

	Group A		*Group B*	
No pain	0	0	2	5.7
Mild pain	1	3%	22	62.8
moderate pain	21	60%	8	22.9
Severe pain	13	37%	3	8.6

Analgesia requirement(hrs): In this study, the rescue medication of choice for treating pain was tramadol (100mg IV) because it is a weak opioid used in hospital routine. In our study mean time for analgesic request in group A is 6.77±1.37 hrs and 10.91±1.93 hrs in group B. significant difference seen in analgesic request (p<0.001).

	Mean	*SD*	*P value*
Group A	6.77	1.37	p<0.001
Group B	10.91	1.93	

Side effects: none of the patients of both groups had severe side effects. Following side effects were observed.

	Group A		*Group B*	
PONV	1	2.85%	1	2.85%
RESP DEP.	-		-	
FNB LOCAL PAIN	-		1	2.85%
Cold Sensation in Limb	-		-	
Weakness Of Quadriceps	-		24	68.57%

68.57% patients had weakness of quadriceps.

4. Discussion

Although new techniques have been developed for postoperative pain treatment, none of them proved to be completely effective; thus, researchers are still trying to improve them. Opioids have been used for treatment and prevention of postoperative pain; however, peripheral nerve blocks have a prominent place [12][15][16].

Patients in this study had no difference in demographic, clinical and surgical profile. We recorded systolic BP, diastolic BP, mean BP, Pulse rate and SPO2 intra operatively and postoperatively at different time interval and there was no significant difference in both groups regarding studied haemodynamic parameters at any time.

We studied motor and sensory effect in nonoperated limb to define the end of spinal anaesthesia effect. In our study at 6hrs there was no motor and sensory effect seen in nonoperated limb. It defines spinal anaesthesia effect completely end.

In our study At 10 hrs mean VAS score was 6.97±0.86 in group A and 3.00±2.00 in group B (p<0.001) and at 12 hrs in group A mean VAS was 6.97±0.86 and in group B mean VAS was 6.26±1.09 (p-0.053). Our results coincide with **chan et al** [17]in that study Pain scores were significantly lower in patients who received FNB before or after ACLR, compared to controls receiving FNB with saline solution.

In **Guirro et** al[19] study there was also significant differerence in VAS at 12 hrs in both groups. **Souza et al**[18]also showed less pain in the assessment between 6 and 10 hours and, in the evaluation between 12 and 24 hours, no difference was found between scores.

At 10 hrs in group A (total 35 patients) 21(60%) patients had moderate pain, 13 (37%) patients had severe pain and 1(3%) patient felt mild pain while in group B(total 35 patients) 2(5.7%) patients had no pain, 22(62.8%) patients had mild pain, 8(22.9%) patients had moderate pain and 3(8.6%) had severe pain.

Similar result was found by **Souza et al**[18] who evaluated patients undergoing knee surgery with spinal anaesthesia, alone or combined with FNB, and those who received FNB had less pain in the assessment between 6 and 10 hours.

In **Guirro et al study** [19]Mean pain scores were higher at 12 hours in GA and there was no change in GB. 55.6% of patients reported moderate pain in GA and 53.8% mild pain in GB(P-0.026).

In our study mean time for analgesic request in group A is 6.77±1.37 hrs and 10.91±1.93 hrs in group B. significant difference seen in analgesic request (p<0.001).

Our result coincide with **Chan MH et al**[17]and **H. Wulf wt al** [9] study. **Chan MH et al** [17]found a significant difference between the patients in the treatment groups(FNB with bupivacaine) and control group (FNB with NS) with regard to the time to first request for morphine in total knee arthroplasty. Mean duration of first analgesic request in

treatment group(FNB with bupivacaine) was 258.1 ± 56.3 minutes and in control group (FNB with NS) was 65.3 ± 14.2 minutes, (p = 0.005)(time calculated after completion of knee arthroplasty surgery). While there was no significant difference in 1st analgesic request in**Guirro et al study[**19]**, Beaupre LA et al study**[16] **and Matava MJ et al study**[21]**.**

Most adverse events presented by patients in this study were not serious. Transient motor paralysis of quadriceps muscle occurred in most patients who received FNB.

All patients in both groups were advised not to walk without an escort and always with the support of crutches. There were 24(68.57%) case of quadriceps muscle weakness in group one while no case of quadriceps weakness was reported in group A.
Our result coincide with **Guirro et al study**[19]**, Sharma S et al study**[7] and **YaDeau et al** [20] results. Guirro et al found 21(81%) cases of quadriceps weakness out of 26 patients of FNB group in their study.

5. Summary and Conclusion

The study was conducted, evaluated post-operative analgesia in case of ACLR with spinal anaesthesia alone v/s spinal anaesthesia + FNB. In this study 70 patients randomized in 2 groups, 35 in each (group A and group B). Pain assessment was done postoperatively at every 2 hr upto 24 hr by VAS score and 1st analgesic request was noted.

After data analysis it can be concluded that postoperative analgesia for ACLR was more effective with combination of spinal anaesthesia + FNB as compared to spinal anaesthesia alone. It was also noted that first rescue analgesic request was delayed in combination of spinal anaesthesia and FNB group as compared to spinal anesthesia group. Adverse events presented by patients in this study were not serious, but one must be aware of quadriceps muscle weakness in early postoperative period and the possibility of falling after FNB. However, despite the techniques used, there are still complains of severe pain in patients undergoing ACLR, suggesting that further studies are needed for adequate control of postoperative pain.

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