Original Research Article

Evaluation of efficacy of femoral nerve block compared to lumbar epidural for pain relief following total knee replacement

Ravi Kiran P[1], Kishore Kumar K[2*], Madhu Salini K[3]

[1,3]Assistant Professor, Department of Anaesthesiology, Balaji Institute of Surgery, Research and Rehabilitation for the Disabled (BIRRD HOSPITAL), Tirupati, Andhra Pradesh, INDIA.
[2]Civil Assistant surgeon specialist, District Hospital Eluru, INDIA.
Email: pramyakeerthi@gmail.com , ravikiran.mbbs@gmail.com

Abstract

Background: Post-operative pain relief after knee surgeries, especially total knee replacement, is a major concern. It is severe in 60% of patients and moderate in 30%. It causes undue distress and hinders early intense physical therapy, considered one of the most important factors for optimal postoperative knee rehabilitation. More attention is to be paid to compare the efficacy of femoral nerve block and lumbar epidural blockade in patients undergoing total knee replacement as a post operative analgesia technique. **Aim:** The study was conducted to evaluate the efficacy of femoral nerve block compared to lumbar epidural blockade for pain relief following total knee replacement and to compare incidence of complications in each group and choose the safer technique. **Materials and Methods**: A Cross sectional study was conducted among 60 patients belonging to both sexes aged between 45-60yrs with ASA physical status 1and 2, who are posted for total knee replacement at the Rangaraya medical college, Kakinada, A.P. They are randomly divided into 2 groups - group 1 and all the patients are premedicated 1hour before scheduled surgery with inj midazolam 0.05mg/kg im, Inj ranitidine 50 mg iv and Inj ondansetron 4mg iv Both the groups were given standard spinal anaesthesia with hyperbaric 0.5% bupivacaine of 3.2ml. at L3/L4 interspace. Intraoperative haemodynamics were monitored. At the end of surgery the dermatomal level was assessed in the both groups. When sensory level was regressed to L2 level to pinprick, group I and group II are instituted femoral nerve block and epidural analgesia respectively. **Results:** The mean VAS at 1,1.5,2,2.5,3,3.5,4, 8, 12, 24, 48 and 72 hours postoperatively were similar between FNB group and EA group. In the initial 24 hours 33.3% of patients in FNB (required diclofenac as against 40% of patients in EA (p=0.592). During the next 48 hours only 16.7% of patients in FNB and 23.3% of patients in EA required diclofenac as rescue analgesia (p=0.561). Incidence of urinary retention was 3.3% in FNB group compared to 10% in EAgroup. The pain relief in patients with FNB and EA to be similar for patients undergoing knee surgeries based on VAS scores. The incidence of urinary retention was not significant between FNB compared to EA. **Conclusion:** Femoral nerve block can be used as an effective postoperative analgesic technique in patients undergoing TKR surgeries.

Key words: Femoral Nerve Block, Lumbar Epidural, Total Knee replacement

***Address for Correspondence:**
Dr Kishore Kumar K, Civil Assistant surgeon specialist, District Hospital Eluru, INDIA.
Email: pramyakeerthi@gmail.com

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INTRODUCTION

The International Association for the study of pain (IASP) defined pain as "an unpleasant sensory and emotional experience, associated with actual or potential tissue damage or described in terms of suchdamage."[3] Post-operative pain relief after knee surgeries, especially total knee replacement, is a major concern. It is severe in 60% of patients and moderate in 30%[1,2]. Though Epidural infusion of a local anesthetic is very effective in providing the analgesia and hastening the recovery, it is associated

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with various side effects like urinary retention, moderate to severe degrees of dizziness and nausea/vomiting on the first postoperative day. Femoral nerve block provides excellent analgesia in the femoral nerve distribution and there is a significant reduction in pain VAS scores for 48 hours, lower post-operative opioid requirements, a reduced incidence of side effects and a shorter hospital stay. Placement of femoral nerve catheter may not reduce the lengthof stay in hospital[4.] This study is designed to compare the efficacy of femoral nerve block and lumbar epidural blockade in patients undergoing total knee replacement as a post operative analgesia technique.

Aim:

1. The Aim of the study is to evaluate the efficacy of femoral nerve block compared to lumbar epidural blockade for pain relief following total knee replacement
2. To compare incidence of complications in each group and choose the safer technique.

MATERIALS AND METHODS

This study was conducted in Department of Anesthesiology, Rangaraya Medical college, Kakinada, A.P. The study design used is a cross-sectional study design; all the assessments in this study were carried out only once. The sample of patients were obtained from those patients who are posted for Total Knee Replacement, Department of Anesthesiology, Rangaraya Medical college, Kakinada, A.P. After getting the approval of the Institutional ethics committee (RMC KKD/2018/IEC/36), the study was commenced. All patients fulfilling the selection criteria were approached and explained about the purpose of the study. Written informed consent was obtained from all potential participants. The sample comprises of 60 patients belonging to both sexes aged between 45-60yrs with ASA physical status 1and 2, who are posted for total knee replacement. The random method of sampling was used to derive the sample. The selection of sample unit is based on chance and every element of study group has a known, non-zero probability of being selected. Sample size is estimated by using the formula $N= 4PQ/L^2$, where, P=Positive factor/prevalence/proportion, Q=100-P, L=Allowed error or precision or variability.

Inclusion Criteria: Patients posted for Knee replacement surgery, Patients aged between 45-60 years, Patients with ASA physical status 1 and 2 and Patients who have given written informed consent

Exclusion Criteria: Patients with history of allergy to study drugs, Patients with cardiovascular disease, renal disease and hepatic disease, Patients who are on anticoagulants and Patients who have contraindications for central neuraxial blockade

Materials: 60 patients belonging to both sexes aged between 45-60yrs with ASA physical status 1and 2, who are posted for total knee replacement are randomly divided into 2 groups - group 1 and 2. All the patients are premedicated 1hour before scheduled surgery with inj midazolam 0.05mg/kg IM, Inj ranitidine 50 mg iv, Inj ondansetron 4mg iv. Both the groups were given standard spinal anaesthesia with hyperbaric 0.5% bupivacaine of 3.2ml. at L3/L4 interspace. Intraoperative haemodynamics were monitored. At the end of surgery the dermatomal level was assessed in the both groups. When sensory level was regressed to L2 level to pinprick, group I and group II are instituted femoral nerve block and epidural analgesia respectively.

GROUP 1: Patients are given femoral nerve block with 0.25% ropivacaine 20 ml single shot with B-BRAUN 22 gauze 5 cm sheathed needle using nerve stimulator with 0.2-0.6mA,2Htz.

GROUP 2: Patients were given epidural analgesia with 0.25 % ropivacaine 20ml as single shot injection at L2/L3 interspace.

The following parameters are observed post operatively

The anaesthesiologist who monitored post operatively and who involved in collection of data was unaware of the group allocation, Analgesic efficacy: visual analogue scores are noted 1,1.5,2, 2.5, 3,3.5 4, 8, 12, 24, 48 hours and 72 hours post operatively, Time to 1st requirement of analgesia (duration of post operative analgesia), Side effects like shivering, nausea, vomiting, hypotension, urinary retention, pruritis, sedation and Consumption of rescue analgesic if VAS > 4 Inj diclofenac 75mg should be given. The use of visual analog scale (VAS) was described at a pre-operative visit. VAS was made using a scale with numbers ranging from 0-10 and shown to the patient. The intensity of pain gradually increased from 0 to 10 which were pointed out by the patient on the scale The effectiveness of analgesia was measured by the Visual Analog Pain Score on movement (O-no pain and 10-worst pain) at 1,1.5,2, 2.5, 3,3.5 4, 8, 12, 24, 48 hours and 72 hours post operatively. Rescue analgesic was provided to the patient with Diclofenac75mg IM, if the patient's VAS score was >3. Dicofenac was given till the VAS score was below 3.

STATISTICAL ANALYSIS

Chi-square test and fisher exact test have been used to test the significance of homogeneity of sex distribution. Student t test (two tailed) had been used to find the significance of mean difference of analgesia (VAS scores), consumption of rescue analgesic, motor blockade and active knee flexion and also to test the homogeneity of samples on age and weight. Changes in variables within each group were analyzed with multiple paired t- tests. A

p value ≤ 0.05 is considered significant. Values are presented as mean ± standarddeviation.

Statistical software: The statistical software namely SPSS 11.0 and Systat 8.0 were used for the analysis of the data. Microsoft word and Excel have been used to generate the graphs, tables and charts.

RESULTS

Table 1: Showing the age and weight of patients under study

Age in years	GROUP 1	GROUP 2	P-VALUE
Mean ±SD	51.83± 3.65	52.83± 3.91	0.311
Weight (kg)	65.40±7.29	64.80±8.71	0.773

The sample comprises of 60 patients belonging to both sexes aged between 45-60yrs with ASA physical status 1and 2, who are posted for total knee replacement are randomly divided into 2 groups - group 1 and 2. There was no significant difference between the group with regard to age (p= 0.311). The mean age of the patients in Group 1 and Group 2 was 51.83±3.65 yrs and 52.83±3.91yrs respectively. There was no significant difference between the groups with regard to age (p =0.311) yrs respectively. There was no significant difference between the groups with regard to age (p =0.311). The mean weight in Group 1 and Group 2 was 65.40±7.29 and 64.80±8.71 kgs respectively. Weight distribution is statistically similar with regard to weight (p=0.773) [Table 1].

Table 2: Showing VAS Pain scores

VAS score	GROUP 1 n=30	GROUP 2 n=30	P value
1 hour	2.03±0.67	2.23±0.68	0.255
1.5 hours	2.17±0.70	2.13±0.63	0.847
2 hours	2.13±0.63	2.23±0.68	0.556
2.5 hours	2.27±0.69	2.10±0.92	0.432
3.0 hours	2.13±0.68	2.17±0.75	0.857
3.5 hours	2.13±0.82	2.13±0.68	1.000
4 hours	2.23±0.94	2.60±1.25	0.203
8 hours	2.83±0.95	2.77±0.94	0.785
12 hours	2.37±1.22	2.43±1.28	0.837
24 hours	2.50±0.90	2.73±1.08	0.367
48 hours	2.47±0.86	2.70±0.99	0.333
72 hours	1.63±0.76	1.83±0.75	0.310

VAS Pain scores were similar between two groups. The VAS Scores for 1,1.5,2,2.5,3,3.5,4,8,12,24,48,72 hours were similar, and not significant between Group 1 and 2 (p=.255, p=0.847, p=0.556, p=0.432, p=0.857, p=1.000, p=0.203, p=0.785, p=0.837, p=0.367, p=0.333, p=0.310) [Table 2].

Table 3 Showing time to first requirement of rescue analgesia

	GROUP 1	GROUP 2	PVALUE
TIME(MIN) (MEAN±SD)	346.90±58.94	338.13±1.74	0.4188

In the initial 24 hours 33.3% of patients in Group 1 required diclofenac as against 40% of patients in Group 2 (p=0.592). During the next 48 hours only 16.7% of patients in Group 1 and 23.3% of patients in Group 2 required diclofenac as rescue analgesia(p=0.561) [Table 3].

Table. 4: Showing consumption of rescue analgesics

TIME (HOURS)	GROUP 1 (n=30)	GROUP 2 (n=30)	P VALUE
24	10(33.3%)	12(40.0%)	0.592
48	5(16.7%)	7(23.3%)	0.561

In Group 1, 1 patients had urinary retention as against 3 patients in Group 2, which was statistically not significant (p =0.613) [Table 4]

Table 5: Showing comparison of incidence of side effects.

Side Effects	Group 1(n=30)	Group 2(n=30)	p Value
Urinary retention	1	3	0.613
Hypotension	Nil	Nil	-
Pruritis	Nil	Nil	-
			-
Others	Nil	Nil	-

None of the patients in either group had hypotension, desaturation, pruritis and nausea or vomiting[Table 5]

DISCUSSION

Effective pain control is a major concern in the postoperative management of knee surgeries and one that has a significant impact on our health care system There is evidence that, when compared with placebo, femoral nerve block improves immediate postoperative analgesia[5,6], prolongs the time to first requested analgesic[5], and reduces 24-hour morphine consumption by 45%[6]. Single-injection femoral nerve blocks (SFNB) have been shown to significantly improve postoperative analgesia and reduce the length of hospital stay compared with systemic opioid therapy afterTKR[7,8]. Previous studies have shown that duration of analgesic effect from a SFNB is typically 12 to 24 h[,9], but may be as long as 48 h[34], whereas severe pain after TKR, especially during physical therapy, may persist through the second day aftersurgery.[10] We conducted a study to compare the efficacy and safety of FNB and EA following knee surgeries with regard to postoperative analgesia. We also compared the amount of rescue analgesic consumed and side effects. There was no difference between the groups with regard to age, sex, weight. The pain relief in FNB group was similar to EA according to VAS score. The number of patients requiring rescue analgesia were lower in FNB than in EA though significantly not significant (p=>0.561). 1 patient in FNB group and 3 patients EA group had urinary retention. No other side effects were reported.

Analgesia

Our results confirm the efficacy of two perioperative techniques employed for post-operative analgesia after total knee replacement surgeries. Of the two, duration of post-operative analgesia is slightly higher in single shot femoral nerve block (FNB) group when compared to epidural analgesia (EA) group. The VAS Scores for 1,1.5,2,2.5,3,3.5,4,8,12,24,48,72 hours were similar, and not statistically significant (p=.255, p=0.847, p=0.556, p=0.432, p=0.857, p=1.000, p=0.203, p=0.785, p=0.837, p=0.367, p=0.333, p=0.310) respectively between the studied group 1 and group 2. Johannes Jauch *et al.*[11] Compared epidural analgesia With Femoral Nerve Block For Postoperative Pain Therapy After Total Knee Arthroplasty. Their study compares clinical efficiency and adverse events of pain therapy of an established epidural analgesia plus patient controlled analgesia (EA+PCA) and a modified femoral nerve block plus patient controlled analgesia (FNB+PCA) protocol. Matched pair analysis was performed using filters for American Society of Anesthesiologists (ASA) classification, age, gender, height, weight, comorbidities and prior use of analgesics. Surgical technique and postoperative medication protocol were similar in both group. From a total of 846 patients, 104 matched pairs were built and analyzed within 72 hours after surgery. Mean VAS scores were similar in patients receiving EA+PCA (2.7 ± 1.1) or FNB+PCA (2.8 ± 1.2). Supplemental opioid administration was higher in EA+PCA patients. Hypotension was more frequent in EA+PCA as in FNB+PCA patients (36 % vs. 12 %). Combined adverse events were more frequent in EA+PCA as in FNB+PCA patients (75 % vs. 58 %). They conclude that Both FNB+PCA and EA+PCA results in equivalent degrees of analgesia after TKA. But Converting an established mode(EA+PCA) of pain therapy to a modified protocol (FNB+PCA)may decrease incidence of adverse events rather than improve quality of analgesia. This results are similar to our results in our study and difference between their study and our study is there is no patient controlled analgesia in our study. Fowler SJ1, Symons J, Sabato S, Myles PS[12] compared Epidural analgesia with peripheral nerve blockade after major knee surgery. They undertook a systematic review and meta-analysis of all randomized trials comparing epidural analgesia with PNB for major knee surgery. Eight studies were identified that had enrolled a total of 510 patients of whom 464 (91%) had undergone total knee joint replacement. All were small trials and none was blinded, PNB technique was variable: in addition to a femoral catheter (n=5), femoral single shot (n=2), or lumbar plexus catheter (n=1) techniques, sciatic blockade was performed in three trials. There was no significant difference in pain scores between epidural and PNB. There was also no difference in morphine consumption Hypotension occurred more frequently among patients who received epidurals, but there was no difference in the incidence of nausea and vomiting. Two studies reported a higher incidence of urinary retention in the epidural group. Patient satisfaction was higher with PNB in two of three studies which measured this, although rehabilitation indices were similar. PNB with a femoral nerve block provides postoperative analgesia which is comparable with that obtained with an epidural technique but with an improved side-effect profile and is less likely to cause a severe neuraxial complication**.** These results are also similar to our study results. Sang-Jin Park, Soo Young Shim, and Sam Guk Park[13] compared continuous femoral nerve block combined with sciatic nerve block and epidural analgesia for postoperative pain management after total knee replacement: Eighty participants undergoing unilateral TKR were randomized to receive either EPA (EPA group) or continuous FNB combined with SNB (PNB group). All patients received general anesthesia for TKR. Ropivacaine 2 mg/ml plus fentanyl 2 g/ml was administered for EPA. Ropivacaine 2 mg/ml was administered through the femoral nerve catheter. The pain score, side effects(dizziness, sedation, nausea, vomiting, pruritus, hypotension and urinary retention), motor blockade, knee range of motion, and rehabilitation were measured postoperativel The incidence of patients with side effects was 86.8% in the EPA group but only 35.1% in the PNB group ($P < 0.001$).There were no significant differences between the two groups in terms of pain score, motor blockade of the operative limb, knee range of motion, or rehabilitation. These results in terms of pain score are similar to our pain score results in our study and side effects were significantly lower in PNB group compared to EPA group which is in contrast to our study as incidence of side effects was insignificant between two groups in our study. In another study by Barrington *et al.*[14], comparing femoral nerve block with epidural analgesia as a postoperative analgesic technique for TKR, there was no significant difference in VAS scores between the two groups. They employed ropivacaine 0.2% with fentanyl 4 μg/ml for epidural infusion and bupivacaine 0.2% for femoral infusion. Zaric *et al.*[15] compared epidural analgesia with continuous femoral-sciatic nerve blocksafter total knee replacement. They employed ropivacaine 2 mg/ml plus sufentanil 1 μg/ml for the infusion. The median VAS scores in epidural group patients were 2.7 (0, 7.5) and 4 (0, 10) and in femoral nerve block group it was 4 (0, 8) and 3.7 (0, 9.3) on postoperative day (POD) one and two respectively. They found no significant difference in VAS scores between the two groups.

Rescue analgesic

In our study in the initial 24 hours 33.3% of patients in Group 1 required diclofenac as against 40% of patients in Group 2 (p=0.592). During the next 48 hours only 16.7% of patients in Group A and 23.3% of patients in Group B required diclofenac as rescue analgesia(p=0.561). Zaric *et al.*[9] in their study found no difference in the amount of morphine consumed on POD1 and POD2 between epidural (32.6±26 and30.2±26.3) and femoral nerve block groups (31±26 and 32.3 ±25.7). In their study the addition of an adjuvant in the form of fentanyl to ropivacaine 0.2% for epidural infusion might have resulted in a better analgesia, reducing the need for rescue analgesic. They also employed a multimodal rescue analgesic protocol in the form of paracetamol, lidocaine / ropivacaine boluses and morphine. There are two different approaches to the analysis of the frequency of side effects after knee surgeries in the literature to form an overview of presence or absence of side effects for each individual patient throughout the observation period. We adopted the latter method to document the side effects.In FNB group, 1 patients had urinary retention as against 3 patients in EA group, which was statistically not significant (p =0.613). In the study by Zaric *et al.*[9], who analyzed the side effects for each day of infusion, the incidence of urinary retention was significantly higher in epidural group compared to femoral nerve block group ($p < 0.001$). Incidence was 69%, 61% and 22% in epidural group and 27%, 12% and 15 % in femoral nerve block on the day of surgery, POD1 and POD2 respectively. In our study though 3 patients in EA group had urinary retention compared to 1 patient in FNB (3 in 1) it was statistically not significant (p=0.613) . In our study none of the patients in either group had hypotension, pruritis, nausea or vomiting. This is in contrast to other studies which have reported a significantly higher incidence of hypotension with EA group compared to FNB group. This may be because of the local anaesthetic solution used in our study was of lesser concentration and also was devoid of any adjuvants.

limitations: The main limitation of this study is there was no control group taken in this study, this may effect the results of the study leading to bias. Patients were blinded to the study drugs but it wasn't possible to blind them to the analgesic technique.

CONCLUSIONS

From our study we found that, Femoral nerve block can be used as an effective postoperative analgesic technique in patients undergoing TKR surgeries. Femoral nerve block is as effective as epidural analgesia in speeding up the goals of knee rehabilitation following TKR. Femoral nerve is a superficial nerve with simple land mark and easy to locate with nerve stimulator. A clear advantage of the peripheral nerve block method is that it can be applied even if patients have received LMWH as thrombosis prophylaxis. Femoral nerve block can be safer alternative approach because there is no central neuraxial intervention and all the related side effects can be avoided while providing similar effective analgesia So in view of above advantages single shot femoral nerve block can be preferred as effective postoperative analgesic technique in TKR surgeries.

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