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Research Paper

Comparison of local anesthetic infiltration to continuous femoral nerve block for post-operative analgesia in total knee replacement patients

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Abstract

Objective: This study compared post-operative analgesic efficacy, morphine consumption, mobilization time and complications of a continuous Femoral Nerve Block (FNB) with Local Infiltration Anesthesia (LIA).

Material and methods: 60 patients scheduled for unilateral total knee replacement under spinal anesthesia, were randomly allocated in two groups FNB and LIA group. FNB group received bolus dose of drug-containing 20 ml of 0.5% levo bupivacaine plus 50 µg of dexmedetomidine plus 80 µg of fentanyl and in post-operative period an infusion of 0.2% ropivacaine was started of 7 ml per hour while LIA group received a mixture of 100 ml prepared by adding 40 ml 0.5% levo bupivacaine plus 60 mg ketorolac plus 15 mg morphine plus normal saline and given in 2 injections. Postoperative pain severity was measured by using VAS scale, rescue analgesia and mobilization time was also recorded.

Result: LIA group had significantly low VAS pain score at 4, 8, 12 and 24 hours postoperatively as compared to FNB group, the mean morphine consumption in LIA group was significantly less 21.06 ± 10.88, LIA 8.16 ± 10.38, p-value <0.001), also in LIA group more than 95% patients were able to do straight leg raising and were able to move with help at 24 hours postoperatively against only 60% patients in FNB group.

Conclusion: LIA is a newer multimodal analgesic method that gives excellent pain control decreases morphine consumption and preserves quadriceps muscle function thereby improving patient satisfaction which plays a vital role in early ambulation and reducing complications.

Keywords: local infiltration anesthesia, femoral nerve block, total knee replacement

INTRODUCTION

Total Knee Replacement (TKR) is a major orthopedic surgical procedure associated with severe post-operative pain [1]. Adequate post-operative pain control in TKR patients is very important as inadequate pain control can lead to delayed mobilization, prolonged hospital stay, deep vein thrombosis with embolic events, increased psychological stress thereby increasing morbidity and mortality of TKR patients [2,3].

Presently available modalities for post-operative pain management in TKR patients are:

1. Oral and Parental Non-steroidal Anti-inflammatory Drugs (NSAIDS) and opioids: They provide inadequate pain relief and are having significant side effects like nausea, vomiting, constipation, gastric irritation, dizziness, respiratory depression hence not preferred as sole agents for post-operative analgesia [4]

2. Epidural analgesia: It provides adequate pain control as compared to opioids but is associated with adverse effects like hypotension, bradycardia, epidural hematoma, urinary retention, prolonged motor block leading to delayed ambulation making it not a method of choice for post-operative analgesia [5-7]

3. Femoral Nerve Block (FNB): It provides good pain relief and its most common adverse effects like nerve damage, local infection are less seen and are avoidable, but the risk of loss of motor power of quadriceps are increased which may lead to frequent falls and delayed ambulation. Other regional nerve blocks like a sciatic nerve block, an obturator nerve block can be used as adjuncts to FNB [8-10]

4. Local Infiltration Analgesia (LIA): Is given in intraarticular and periarticular in the knee joint. It is a simple and effective method for providing post-operative analgesia without significant side effects. It decreases the need for consumption of opioids and preserves motor power and makes earfly ambuflaftfion possfibfle [5,11]

MATERIALS AND METHODS

After approval from the institutional ethical committee, this prospective study was conducted at Fortis hospital Kolkata. 60 patients aged between 42 to 76 years who underwent unilateral knee replacement from November 2018 to January 2019 of ASA grade I to III were included in this study. Patients were randomly allocated in two groups, each group consisting of 30 patients, group 1 FNB: In these patients continuous femoral nerve block was given and group 2 LIA: In these patients, local infiltration anesthesia was given.

Age, weight, sex, and height of each patient were noted, patients were educated about Visual Analogue Scale (VAS) for pain score of 0 to 10, 0 means no pain and 10 means most severe pain one can have. Pre-anesthetic checkup was done one day prior to surgery. Patients who were having sensory pain disorder of the affected limb, allergy to any drugs used in the study, chronic systemic disorders and bilateral knee replacements were excluded from the study.

Under aseptic conditions, all TKR patients were operated under spinal anesthesia using 26 gauge Quincke needle at L3-L4/ L4-L5 (Lumbar) space and 3 ml of 0.5% heavy bupivacaine plus 20 μg fentanyl was given after ensuring the free flow of clear cerebrospinal fluid in sitting position. Vitals blood pressure, heart rate and oxygen saturation (SpO_2) were recorded preoperatively, intraoperatively and postoperatively.

Group 1 FNB: Under all aseptic precautions landmarks for FNB were identified (lateral to the femoral artery). With the help of nerve stimulator and Tuohy needle, the femoral nerve was identified after eliciting a patellar twitch with a current ranging between 0.3 to 0.5 mA (Milliamperes). A bolus dose of the drug (20 ml of levobupivacaine plus 50 μg of dexmedetomidine plus 80 μg (microgram) of fentanyl) was given after negative aspiration via 20 gauge Tuohy needle. Then a femoral catheter 24 gauge was inserted 5 cm deep to needle tip and fixed in place. In postoperative period an infusion of 0.2% ropivacaine was started at 7 ml per hour and the catheter was removed at 48 hours post-operatively at least 10 hours after giving the last dose of subcutaneous low molecular weight heparin.

Group 2 LIA: A mixture of 100 ml was prepared by adding 40ml 0.5% levo bupivacaine plus 60 mg ketorolac plus 15 mg morphine plus normal saline and given in 2 injections, 50 ml was given initially in posterior capsule just before the prosthesis fixation and remaining 50 ml was given later before wound closure deep in the incision edges by the operating surgeon.

RESULTS

Among 30 patients of FNB group 18 were males and 12 were females with a mean age of 58.34 years, out of them 8 were ASA grade I, 18 were ASA grade II and 4 were ASA grade III. Whereas in LIA group out of 30 patients 17 were females and 13 were males, 10 were of ASA grade I, 16 of ASA grade II and 4 were ASA grade III. Body mass index and duration of surgery of the two groups in the study was comparable with a non-significant p-value of 0.26 and 0.28 respectively (Table 1).

Visual Analogue Scale pain score of LIA group was statistically significantly lower than the FNB group at 4, 8, 12 and 24 hours post-operatively. While the difference of pain score of the two study groups at 48 hours was statistically insignificant (Table 2).

Rescue analgesia in the post-operative period for pain management

Table 1. Body mass index and duration of surgery of the two groups

Group	Sex		Age	ASA grade	BMI	Duration of surgery (minutes)
FNB	M=18	F=12	62.40 ± 7.19	I =08, II =17, III = 05	28.29 ± 3.55	96.06 ± 12.14
LIA	M=17	F=13	63.86 ± 7.16	I =10, II =16, III = 04	27.34 ± 2.90	92.80 ± 11.06
BMI: Body Mass Index; ASA grade: American Society of Anesthesiologist						

Table 2. Visual analogue scale score at 4, 8, 12, 24 and 48 hours postoperatively

Time	4 Hours	8 Hours	12 Hours	24 Hours	48 Hours
FNB (mean ± SD)	3.9 ± 1.18	4.7 ± 0.91	3.93 ± 1.11	3.5 ± 0.86	2.63 ± 0.61
LIA (mean ± SD)	3.1 ± 0.80	3.73 ± 1.25	2.84 ± 1.19	2.7 ± 0.95	2.56 ± 1.22
P-Value	0.0032	0.0011	0.0007	0.0012	0.77
Confidence Interval (95%)	-1.23 to -0.27	-1.53 to -0.40	-1.66 to 0.47	-1.26 to -0.33	-0.56 to 0.42
Standard error	0.260	0.28	0.29	0.23	0.249
VAS: Visual Analogue Scale; SD: Standard Deviation					

Table 3. Morphine consumption during hospital stay

Morphine consumption During hospital stay	FNB	LIA	p-value
	21.16 ± 10.88	8.16 ± 10.38	<0.001
FNB: Femoral Nerve Block; LIA: local Infiltration Anesthesia			

that every patient received: Paracetamol: 1 gram 8 hourly and Tramadol: 100 mg 8 hourly. Patients were given local cold fomentation in the form of ice packs every 2 hours for 10 minutes. Patients who complain of pain even after giving the above drugs, morphine was added. The mean morphine consumption was lower in the LIA group than in the FNB group in the post-operative period of TKR patients with significant p-value <0.0001 (Table 3).

Mobilization: Patients were asked to do straight leg raising test after 24 hours of surgery, in FNB group 18 out of 30 (60.66%) patients were able to perform SLR whereas in LIA group 29 out of 30 (96.7%) patients were able to perform Straight Leg Raising (SLR). Time interval between surgery and the ability to walk with support of physiotherapist was less in LIA group than FNB, 29 out of 30 (96.7%) of LIA group patients were able to walk with support, whereas only 16 out 30 (53%) of FNB group patients were able to walk with support at 24 hours of surgery .

Complications: In FNB group 6 patients had post-operative nausea and vomiting (PONV), one developed femoral neuropathy and one patient had in hospital fall. In LIA group 5 patients had PONV and none of the other local or systemic complications were seen during a post-operative hospital stay.

DISCUSSION

TKA being a painful procedure requires adequate post-operative pain relief and failure to provide adequate pain relief during the early post-operative period becomes a risk factor for these patients to develop chronic pain [9].

FNB is a newer modality of pain management. It is safe without significant systemic complications, has high successes rate, provides pronged analgesia with minimal discomfort to the patient but following complications may be seen with this vascular puncture, femoral nerve compression, and injury, a delayed reversal of muscle power leading to frequent falls [8-13]. LIA is a simple and cost-effective method for providing post-operative analgesia, does not require special equipment like nerve stimulator, USG (ultrasonography) or specially trained person. It is a time-saving procedure given by operating surgeon directly into the target tissue, provides better post-operative analgesia and decreases the need for opioid consumption, without interfering with motor power of operated limb muscles and making early ambulation possible without any complication [14-17].

The mean pain at 4 hours post-operative was significantly less in LIA group with value on VAS of 3.1 ± 0.80 as compared to 3.9 ± 1.18 in FNB with a p-value of 0.0032, similarly at 8 hours, 12 hours and 24 hours pain score was significantly less in LIA group than FNB group Table 2.

Ng et al., in his study compared continuous femoral nerve block with local anesthetic infiltration for post-operative pain management in TKR patients and concluded that LIA gives better pain control than FNB without causing any significant systemic side effects [18]. While as Affas F, in his study compared LIA with continuous FNB for providing post-operative analgesia in TKR patients, found marginally lower pain scores in the LIA group than FNB group [11].

Toftdahl K, Ashraf A, Haytham R, Ilfeld BM compared LIA with single shot FNB in providing post-op analgesia in total knee replacement patients and concluded that LIA is superior to FNB for providing post-operative pain relief [14,15,19,20]. However, Chaubey D and Zhang LK compared LIA with continuous FNB, found that FNB has a lower pain score in the post-operative period without any added adverse effects than LIA [9,21].

Rescue analgesia: Our study shows LIA group of patients have lower morphine consumption (mean 8.16 ± 10.38) than FNB group (mean 21.16 ± 10.88), with a p-value <0.001, similar results were also seen by Ashraf et al. [15], Moghtadei et al. [22] and Affas et al. [11]. Kenji Kuroska et al. concluded in their studies that total opiate consumption was less in the LIA group than FNB group in the first 24 hours postoperatively [23].

However, In a meta-analysis of 10 studies from 1996 to 2017 local anesthetic infiltration and femoral nerve block have similar efficacy for pain control in terms of visual analog scale pain score at 24 hours and similar morphine consumption [21]. Also Haythem et al. and Rosn et al. found no significant difference between LIA and FNB groups in post-operative narcotic consumption in TKR patients [19,24].

Mobilization: In our study, 60% of FNB patients were able to do straight leg raising and only 53% were able to mobilization with the help of walker at 24 hours, while as more than 95% of LIA patients were able to do straight leg raising and walking with the help of walker and physiotherapist. These findings are also supported by literature Bin H which concluded that LIA preserves quadriceps muscle function resulting in early ambulation and decreased hospital stay length and Antoni et al. which concluded that LIA helps in early rehabilitation and decreases hospital stay [16,17].

Complications: In FNB group one patient (3%) had fallen and one (3%) had femoral neuropathy however due to the small size of sample this percentage may not represent the actual percentage of patients who reported complications. Sharma et al. reported femoral neuritis in 0.7% and fall in 1.6% and atrial fibrillation in 0.7% of FNB patients [25]. Feibel RJ reported 1.3% complication rate in 1192 TKR patients attributed to a femoral nerve block, half (n=8) had femoral nerve palsy and a half (n=8) had fallen in the post-operative period [26].

CONCLUSION

In our study, we concluded that the LIA group of patients experience better pain relief, decreased need for morphine consumption in the postoperative period. LIA is easy to administer, time-saving, cost-effective, safe and provides early functional recovery of quadriceps muscles leading to early ambulation as compared to continuous FNB.

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