

EFFICACY OF LOCAL INFILTRATION ANALGESIA IN THE EARLY POSTOPERATIVE PERIOD AFTER TOTAL KNEE REPLACEMENT

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Abstract

Background: Total knee replacement (TKR) is a commonly performed surgical procedure, all across the world. Its popularity and acceptance is increasing exponentially, due to long term successful outcome. However, TKR may be associated with severe postoperative pain, usually requiring prolonged hospital stay and relative immobilization of the patient, may cause unwanted medical problems like nosocomial infections, DVT and poor surgical outcome. Total knee arthroplasty (TKA) may provoke intense early postoperative pain affecting the patient's satisfaction for surgery. Although continuous femoral nerve block (FNB) has been used for pain control, its benefits should be weighed against the potential problems related to its use, which include nerve injury, local infection, and impaired muscle control. Local infiltration analgesia (LIA) is becoming more commonly used owing to the excellent pain relief, the low frequency of complications, and the anti-inflammatory effect. The present study was conducted to assess the pain relief postoperatively using visual analogue score (VAS) and the knee range of movements (knee flexion and extensor lag) postoperatively after local infiltration of analgesic. **Materials and Methods:** The observational study conducted during March 2019 to October 2020, 42 patients undergoing total knee replacement with local infiltration analgesia Patients were evaluated clinically and radiological at the time of the presentation. Patients with allergy to any of the study drugs, uncontrolled diabetes and hypertension were excluded from the study. Quality of analgesia was estimated by using visual analogue score of 0 to 10 at 6hr, 24hr, 48 hrs, and 72hrs after surgery during the rest and movement and knee range of movements was assessed postoperatively using goniometer. **Result:** Among the 42 patients, the age of the patients ranged from 60 to 73 years with the mean age of the patients being 68 years. Among the 42 patients, 26 were female and 16 were male. Among the 42 patients 20 patients underwent right knee TKR and 22 patients underwent left knee TKR. A local infiltration injection of a mixture (cocktail) of drugs before and after the implantation of the components. VAS, knee flexion and extensor lag was measured postoperatively at 6hrs, 24hrs, 48hrs, 72hrs respectively. Our results showed that postoperative VAS was significantly better till 48 hours postoperatively. KF improved significantly postoperatively. There was improvement in the extensor lag from postoperative day three. **Conclusion:** The intraoperative periarticular injection with ropivacaine, ketorolac and adrenaline showed better early postoperative pain relief up to 72 hours postoperatively. There was improvement in the knee flexion postoperatively and also there was improvement in extensor lag from postoperative day three. Further study is needed to determine if additional medications or changes in the medication concentrations in the injection could provide added benefit or long term functional improvements beyond the perioperative period. LIA can be compared with other modalities of postoperative pain relief like femoral nerve block, epidural analgesia to show that LIA is better than other modalities for early postoperative pain management after TKR.



INTRODUCTION

Total knee replacement (TKR) is a commonly performed surgical procedure, all across the world. Its popularity and acceptance is increasing exponentially, due to long term successful outcome. However, TKR may be associated with severe postoperative pain, usually requiring prolonged hospital stay and relative immobilization of the patient, may cause unwanted medical problems like nosocomial infections, DVT and poor surgical outcome.^[1]

Total knee arthroplasty (TKA) may provoke intense early postoperative pain affecting the patient's satisfaction for surgery; however, the most effective analgesia remains controversial. Although continuous femoral nerve block (FNB) has been used for pain control, its benefits should be weighed against the potential problems related to its use, which include nerve injury, local infection, and impaired muscle control. Local infiltration analgesia (LIA) is becoming more commonly used owing to the excellent pain relief, the low frequency of complications, and the anti-inflammatory effect.^[2]

In recent years, there is a growing interest in the use of local infiltration analgesia (LIA) containing various constituents as a modality of postoperative pain control. The advantage of LIA is the ability to provide pain control without interfering with lower extremity motor strength, thereby allowing early mobilization of patients. Studies have shown that LIA is consistently more effective in the treatment of postoperative pain after TKA when compared with placebo. LIA constitutes an additional form of analgesia, in which an analgesic is administered locally in to the surgical wound. The injection usually contains a mixture of an anaesthetic drug and a NSAID, to which epinephrine or a corticosteroid can be added. LIA is easy to use, relatively cheap, and many authors concluded that it reduces pain and opioid consumption.^[3,4]

This is an observational study of patients with osteoarthritis of the knee undergoing TKR with LIA conducted at our institution to assess the pain relief and knee range of movements postoperatively

Objectives

1. To assess the pain relief postoperatively using visual analogue score.
2. To assess the knee range of movements (knee flexion and extensor lag) postoperatively.

MATERIALS AND METHODS

42 patients who gave written consent and undergoing Total Knee Arthroplasty with local infiltration analgesia in our institution were included in this study. The study duration was from March 2019 to October 2020. Patients were followed up at 6 hours, 24 hours, 48 & 72 hours postoperatively. With Alpha = 0.05 and estimated proportion (p) = 0.041 and error (d) = 0.06, sample size determined was 36.

Inclusion Criteria

Patients with osteoarthritis of knee undergoing total knee replacement with local infiltration analgesia and non-allergic to any of the study drug.

Exclusion Criteria

Uncontrolled hypertension and diabetes and severe deformity of the knee- varus > 30-degree, fixed flexion deformity >30 degree and valgus knee.

Demographic details and history of the patients was taken along with clinical examination of diseased knee for any fixed flexion contracture, varus or valgus deformity and instability. Standard radiographs for the knee – standing antero-posterior view and a lateral view were obtained. The radiographs were assessed for reduction in joint space, presence of osteophytes, subluxation of tibia, any bone defects and quality of the bone.

Technique of local infiltration analgesia:

A local infiltration injection of a mixture (cocktail) of drugs was given using spinal needle. Ropivacaine 0.25% (25 ml), Ketorolac 30mg (1ml), Adrenaline 1mg (1:1000) (1ml), Normal saline 0.9 % (73ml) to make solution of 100 ml. The first 50 ml was injected before implantation of the components. Then while the cement is curing additional 50 ml was infiltrated. Efficacy of analgesia was estimated by using visual analogue score (of 0 to 10 at 6hr, 24hr, 48hr, and 72hr after surgery during the rest and movement and knee range of movements was assessed postoperatively using goniometer.

The sites of injecting local infiltration prior cementation were at 1) Posterior capsule, 2) Femur-medial and lateral periosteum, posterior periosteum, suprapatellar /quadriceps tendon 3) Tibia- fat pad, 4) Pes anserinus, medial collateral ligament, 5) Circumferential periosteum

After cementation was at

- 1) mid line quadriceps tendon,
- 2) Retinaculum, 3) Subcutaneous tissue

Data was collected and entered in excel sheet and was analysed using paired t test. This was applied to check the presence of a significant difference in outcome variable between the two groups. Software SPSS 20 was used for the statistical analysis. P value of <0.001 was considered significant. Analysis of variance was used for difference in change among time intervals and demographic data was presented and ratio and proportions.

RESULTS

A total of 42 patients with osteoarthritis of knee undergoing total knee replacement with local infiltration analgesia were included in the study. Age of the patients ranged from 60 to 73 years, the mean age of the patients was 68.02 ± 2.63 years. Among the 42 patients in this study, 16 patients (38.1%) were male and 26 patients (61.9%) were females. 20 patients (47%) among the studied patients underwent left knee TKR and 22 patients (52.4%) underwent right TKR. The KF & EL values measured were in

degree of movement measured using goniometer. Both visual analogue scale and knee movement range showed significant difference at different intervals measured at 6hr, 24hr, 48hr & 72hrs. Visual analogue

scale indicates decreasing pain and knee movement range increasing effectively post operatively which was statistically significant.

Table 1: Analysis of Variance of VAS & Knee range movements

Parameter (n=42)	6hr	24hr	48hr	72hr	
Visual Analogue Score (VAS)	5.31±0.47	4.12±0.57	2.55±0.59	1.33±0.48	F=446*
Knee Flexion (KF)	20±0.24	35.24±5.05	57.38±7.98	74.29±6.3	F=747*
Extensor Lag (EL)	10.2±0.52	14.05±4.97	18.57±3.54	12.86±4.57	F=36*

DISCUSSION

Total knee replacements (TKRs) are known to be very successful procedures they are often associated with lengthy and painful recoveries. Great strides have been made in the last several years in minimizing patient discomfort and enhancing their recovery. Less invasive surgical approaches, more selective soft tissue balancing, improved patient education, and perhaps instrument and implant design have all contributed to an overall easier recovery for a patient undergoing TKR. However, improvements in pain control deserve the greatest credit for the more rapid recoveries that are now being seen.^[5]

Post-operative pain control after TKR offers a clinical challenge. Pain contributes to immobility related complications, prolonged hospital stay and interferes with optimal post-operative knee rehabilitation. Arthrofibrosis and diminished range of movements are closely related to degree of post-operative pain.^[6] Hence, pain control after total knee arthroplasty is of prime importance in the immediate postoperative period for early rehabilitation. Numerous different methods of postoperative analgesia are available, but each has its own risk of adverse side effects. Epidural/spinal anaesthesia provides excellent analgesia but can be associated with postoperative headaches, intraoperative hypotension, risk of spinal infection, and delayed use of deep venous thrombosis (DVT) prophylaxis medications. Regional anaesthesia carries the risk of injury to the neurovascular structures, infection, and hematoma formation. Narcotics routinely administered for pain control may cause nausea, vomiting, somnolence, respiratory depression, decreased gut motility, and urinary retention.^[7]

The concept of pre-emptive analgesia and multimodal pain management protocols is being more commonly used to achieve the early patient recovery and to reduce the surgical morbidity. Local infiltration analgesia is an integral component of the regimens followed. After Kerr and Kohan published their early reports on benefits of LIA in 2008, various Authors supported their concept and developed their own regimen for LIA. Many drug regimens were developed which included pre-emptive analgesics and showed a significant improvement in the recovery of the patient after the surgery.

Local infiltration analgesia is advantageous over regional peripheral blocks, in the way that they can

be administered by operating surgeon himself into the pain-sensitive tissues in the field of surgery without any specific skill set, and all the more, they do not block the motor power which hastens the recovery and rehabilitation. Avoiding or limiting the use of narcotics has been beneficial to the patient in many ways.^[8]

Many authors have suggested their own combination of drugs for LIA. Majority of them has a long-acting local anaesthetic in addition with epinephrine and other adjuvants like opioids, corticosteroids, antibiotics in their composition. Although identification of most effective regimen has not yet been made out. However recent studies have shown that the combination of ropivacaine, ketorolac, epinephrine and dexmedetomidine as a local infiltrative analgesic cocktail has been effective which has been evident from the studies.^[8]

Our results of VAR were similar to a randomized trial of 160 patients, Kelley TC et al,^[9] found that patients who received a PAI with ropivacaine, ketorolac, and clonidine had a significantly lower VAS pain at 6hrs, 24hrs, 48hrs and 72hrs respectively and they did not find a statistical difference in narcotic consumption in both the groups.

In a prospective study of 72 patients, Hanajagi MY et al,^[6] found that the pain was significantly more in LIA group when compared with the EA group on postoperative day 1,2,3 and 4 and also, they also found that continuous epidural pump postoperatively had more beneficial effect on pain scores.

In a randomized trial of 25 patients, Gautam VK et al,^[10] found that both the cocktail regimens are effective in controlling the postoperative pain up to 36hrs after the surgery and also, they found that the patients in the group B used less rescue analgesia then the group A and also patient's satisfaction was better in group B patients. In a randomized trial of 254 patients.

Barasteugi et al,^[11] found that patients who received LIA had a lower VAS at 36 hours after the surgery when compared with the FNB group but this benefit was not maintained upon discharge and they found that LIA is a safe adjuvant to FNB reduce the perioperative in TKR which would facilitate the patient's participation in fast-track rehabilitation programmes. In a randomized trial of 60 patients.

Our results showed that the mean KF & EL at 6hrs, 24hrs, 48hrs and 72hrs was 20, 35.24, 57.38, 74.29 & 10,14.05,18.57 and 12.86 respectively, which was significant difference in contrast to randomized trial

of 160 patients conducted by Kelley TC et al,^[9] found no significant differences in active flexion and extensor lag in the patients who received a PAI with ropivacaine, epinephrine, ketorolac, clonidine when compared with patients receiving ropivacaine and epinephrine and they also found that there was no differences among the groups at the 6 weeks postoperative visit.

In a prospective study of 72 patients, Hanajagi MY et al,^[6] found that the ROM was significantly observed more in the EA group than in the LIA group at 48 and 72 hrs., however, there was no significant difference at 96hrs between the two groups and also, they found that ambulation with support was possible only in the LIA group by day one.

Ambulation was not possible in the EA group by 96 hours. In a randomized trial of 25 patients. Gautam VK et al,^[10] found that there was no significant differences in KF in both the groups up to postoperative day five but the patients in the group b had a better KF at 24h and 7 days after the surgery than the group a patients. They also reported that the group b patients who received bupivacaine had a lower extensor lag up to postoperative day five when compared with the patients receiving ropivacaine after which, the average extensor lag was not much different and that quadriceps strength was better up to 10 days in the group b and after 2 weeks the quadriceps strength was almost equal in both the groups.

In a randomized trial of 254 patients. Barasteugi et al,^[11] found that there was no differences in the KF in both the groups up to postoperative day 5 and both the groups reached ROM objectives at 15 days follow up. However, in contrast Chaumeron et al,^[12] reported that patients who received LIA had a better KF up to postoperative day 5 when compared with the patients who received FNB experienced motor block. They also reported who received FNB were unable to do a straight leg rise on postoperative day 1 to 3 when compared with PAI who were able to perform active extension.

CONCLUSION

The intraoperative periarticular injection with ropivacaine, ketorolac and adrenaline showed better early postoperative pain relief up to 72 hours postoperatively. There was improvement in the knee flexion postoperatively and also there was improvement in extensor lag from postoperative day three. More study is needed to determine if additional medications or changes in the medication

concentrations in the injection could provide added benefit or long-term functional improvements beyond the perioperative period. LIA can be compared with other modalities of postoperative pain relief like FNB, EDA to show that LIA is better than other modalities for early postoperative pain management after TKR.

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