

Case Series

Intra-operative peri-articular cocktail injection in inflammatory arthritis patients undergoing total knee arthroplasty

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ABSTRACT

Pain following TKA is often severe in most patients. The purpose of this case series was to assess the efficiency of intra-operative peri-articular cocktail injection in management of pain following total knee arthroplasty. This case series involves 16 patients with inflammatory arthritis of knee undergoing total knee arthroplasty (TKA). All patients had received peri-articular cocktail of drugs before the implantation of prosthesis with cement. In our study, there was significant improvement of Knee Clinical Score and Knee Functional Score following TKA. The mean KSS score was 37.5 (range: 31-44) improved to 92.5 (range, 86-99) and the functional score improved from 25.5 (range, 18-33) to 76 (range, 72- 80) at 6 months and 93 (range: 90-96) at 12 months. Intraoperative peri-articular injection with 20 ml of 0.5% ropivacaine, 1 ml of ketorolac, 1ml of clonidine and 0.5ml noradrenaline diluted in 20 ml of saline is effective in reducing immediate post-operative pain and thereby improving the overall functional outcome.

Keywords: Periarticular injection, Cocktail injection, Total knee arthroplasty

INTRODUCTION

The primary importance of a joint replacement surgery is to achieve good functional outcome post operatively. In patients with advanced inflammatory arthritis of knee, total knee arthroplasty (TKA) has been the most rewarding surgical procedure as it improves the quality of life of the patient.¹ Though, total knee arthroplasty (TKA) for advanced inflammatory arthritis shows excellent outcome, management of post-operative pain still poses a huge challenge for the surgeon.

Pain following TKA is an overwhelming issue which is severe in approximately 60% of patients and moderate in approximately 30%.³ Postoperatively, patients do not have adequate amount of sound sleep and are not able to participate in early post-operative rehabilitation and

physical therapy as a result of pain. However, management of early post-operative pain is vital in reducing the duration of hospital stay, increasing patient satisfaction, and it may also minimize the potential for complications like pneumonia or life threatening deep vein thrombosis.⁴ Therefore, adequate management of postoperative pain aids in early post-operative rehabilitation and thereby having a direct positive influence on the overall outcome.

Regional nerve blocks have high risk of injury to various neurovascular structures causing diminished muscle control and nerve damage, hematoma formation eventually causing infection.⁵ Patient controlled analgesia (PCA) administration of systemic opioids is associated with nausea, vomiting, respiratory depression, drowsiness, pruritus, urinary retention and reduced intestinal motility leading to constipation. Continuous intra-articular

analgesic infusion may cause joint effusion, further creating direct access to the infectious agents.⁶⁻⁸

A contemporary approach to management of pain aims at controlling local pain pathways and receptors within the knee. This has been achieved by local administration of peri-articular cocktail injection in the surgical site which showed very less systemic side effects. It helps in maximizing muscle control, promoting early post-operative rehabilitation and also reduces venous stasis. This is cost-effective, easy to administer without causing motor blockade and does not require any extra special technical skill.⁹ The peri-articular cocktail injection is based on the principle of multimodal therapy which is the use of various interventions that target several different steps of the pain pathway, allowing agents to act in synergism while requiring lower total doses of each drug. This eventually promotes more effective pain control with minimal side effects.¹⁰

The aim of this study is to assess the efficiency of intra-operative peri-articular cocktail injection in management of pain (sensory function) following total knee arthroplasty(TKA) using Visual analogue score (VAS) for upto 72 hours post-operatively in every 12 hour interval, early post-operative mobilisation and rehabilitation (motor function) by 2 minute walking test at 48 hours, 6 minute walking test at 6 weeks and follow up with Knee Society Score (KSS) at 6 months and 1 year respectively.

CASE SERIES

We present a series of cases from January 2016 to December 2019 which includes a total of 16 patients (both male and female patients between 55 and 80 years) with inflammatory arthritis of knee undergoing total knee arthroplasty (TKA). All patients had grade 3 or above based on modified Kellgren-Lawrence classification.

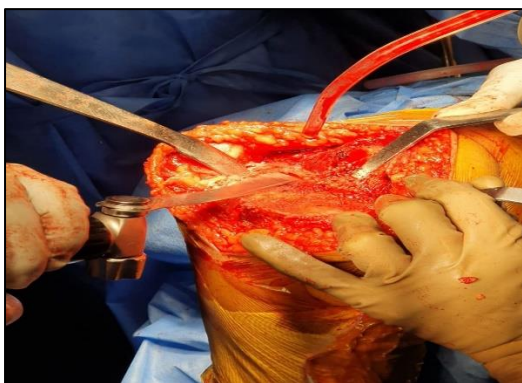


Figure 1: Appropriate femoral and tibial cuts are made for periarticular cocktail injection.

We excluded patients with BMI of more than 35, psychiatric disorders, alcohol dependent patients, revision TKA, patients with profound varus (>20 degrees). This study was approved by the Institutional Ethical Committee

and the patients gave informed consent to participate in this study.



Figure 2: Femur and tibia bone sections for injecting periarticular cocktail before placement of prosthesis.

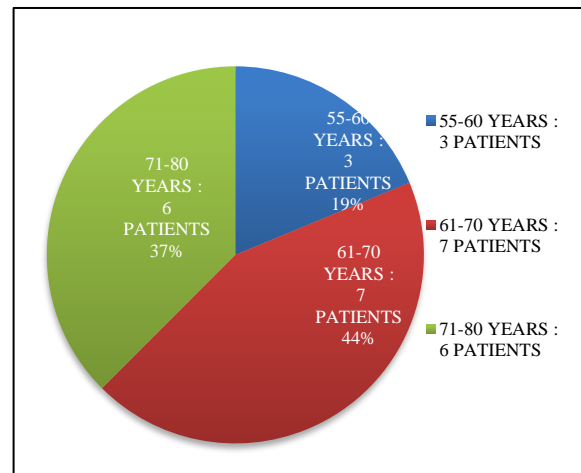


Figure 3: Age distribution.

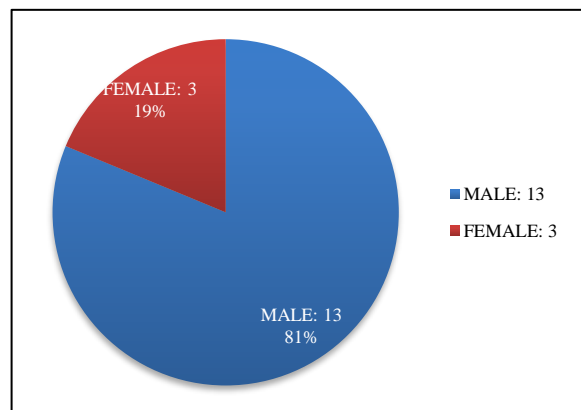


Figure 4: Sex distribution.

All patients underwent the surgery under spinal anaesthesia (2-2.8 ml of 0.5% sensorcaine) wherein epidural catheter was also placed in situ to be used when required. Antibiotic prophylaxis (Cefuroxime 1.5 gm) was administered ½ hour before the skin incision. A mid-vastus surgical approach was used in all patients without

tourniquet. Appropriate femoral and tibial cuts were made prior to administration periarticular cocktail injection. (Figure 1) (Figure 2) A cemented cruciate retaining total knee prosthesis with deep dished tibial insert was used. All patients had received peri-articular cocktail of drugs before the implantation of prosthesis with cement wherein the composition of the cocktail was 20 ml of 0.5% ropivacaine (long-acting local anaesthetic), 1 ml of ketorolac (non-selective Cyclo-oxygenase (COX) inhibitor), 1ml of clonidine (centrally acting alpha agonist) and 0.5 ml noradrenaline diluted in 20ml of saline (total volume – 42.5 ml).

The cocktail injection was administered in five anatomical regions:

Region I: Postero-lateral capsule and posterior rim of lateral meniscus (5 ml),

Region II: Femoral attachment of posterior cruciate ligament (5 ml),

Region III: Posterior capsule (10 ml),

Region IV: Quadriceps tendon, medial periosteum, suprapatellar pouch, prepatellar pad of fat (15 ml),

Region V: Subcutaneous tissue (prior to closure – 7.5 ml).

Closure was performed after achieving complete haemostasis. Injection Tranexamic acid 500 ml was given through the drain and secured to be opened 2 hours postoperatively. In the postoperative period, patients received Injection Paracetamol 1 gm every 8th hourly.

The Visual analogue score was used for grading the pain every 12th hourly for 72 hours and if the score was more than 4, rescue medications (Injection Tramadol and Injection Ketanov) were given. Early postoperative mobilization, 2 minute walking test (MWT) was done at 48 hours after surgery. All the patients had mechanical prophylaxis (calf pump) and anti-thromboembolic stockings for deep vein thrombosis prevention instead of low molecular weight heparin. On 2nd postoperative day, suction drain was removed and were started on Tab. Aspirin 75mg. Sutures/staples were removed on 12th postoperative day. All patients were advised not to squat or sit cross-legged. The walking support was slowly weaned off by the end of 3rd week. At 6 weeks, 6 minute walking test was done. They were asked to review at regular intervals at 6 months and 1 year for knee function scoring using the Knee Society Score (KSS).

The Visual analogue score (VAS) consists of a 10 cm line, in which a score of 0 indicates no pain and 10 indicates the worst imaginable pain. Pain during the postoperative period over the operated knee was recorded by the nurse, who was blinded about the study, using a visual analogue score at 12, 24, 36, 48, 60 and 72 hours.

Early postoperative mobilisation (2 minute walking test) was initiated at 48 hours after surgery, postoperative range of active flexion was also noted each day till the third postoperative day and then at 6 weeks, 6 minute walking test was also done by the physiotherapist, who was also blinded about the study. Vitals were monitored which included blood pressure, heart rate, and oxygen saturation along with adverse reactions like allergic reactions, nausea, vomiting, urinary retention, or respiratory depression till the patients were discharged.

In our study, we had 16 patients of which 3 patients were between 55-60 years, 7 patients were between 61-70 years and 6 patients were between 71-80 years. (Figure 3) There were 3 females and 13 male patients. (Figure 4) 6 patients (37.5%) had left sided osteoarthritis and 10 patients (62.5%) had right sided osteoarthritis had undergone total knee arthroplasty. The mean VAS pain score was 3 on POD 0 and VAS pain score was 2 on postoperative day 1 and 2. The pain score did not increase there on from the 3rd post-operative day. Only 4 patients had a pain score of 4 on the 1st postoperative day who received Injection Ketorolac as rescue medication. The pain score did not increase any further from the 4th postoperative day. None of the patients were given Injection Tramadol for pain relief. All the patients in our study group were comfortably mobilized with a walking aid from the 2nd post operative day. The 2 minute walking test done at 48 hours showed that 13 patients (81.2%) were able to walk distance of 40 meters. The rest of the 3 patients (18.7%) were not able to do the 2MWT due to dizziness. The average duration of stay in the hospital was 5 days. The 6 minute walking test done at 6 weeks showed that all the patients were able to walk an average of 550 meters. In our study, there was significant improvement of Knee Clinical Score and Knee Functional Score following TKA. The mean KSS score was 37.5 (range: 31-44) improved to 92.5 (range, 86-99) and the functional score improved from 25.5 (range, 18-33) to 76 (range, 72- 80) at 6 months and 93 (range: 90-96) at 12 months.

DISCUSSION

In total knee arthroplasty, surgical trauma to the tissues exaggerate the neurological responses broadly by two ways: reducing the threshold of afferent nociceptive neurons and central sensitization of excitatory neurons which eventually contributes to increased sensitivity to postoperative pain.² Altogether these changes contribute to hypersensitivity to postoperative pain, thereby increasing the response to noxious stimuli and decreasing the pain threshold at the site of the injured tissue as well as surrounding uninjured tissues.¹¹ Therefore, a multimodal approach for postoperative pain control has been particularly effective not only in reducing postoperative pain but also in aiding earlier rehabilitation and improving postoperative range of movement. It also reduces the complications of other modalities of pain management such as patient-controlled anesthesia (PCA), continuous epidural anesthesia, and femoral nerve block.¹²

The rationale of using the analgesic cocktail was to facilitate contraction of the smooth muscles that line the arterioles to potentially decrease intra-articular bleeding and to prolong duration of action of the agents in that region wherein epinephrine in the cocktail is especially conspicuous in this regard.^{11,13} Ketorolac acts as an anti-inflammatory and analgesic, in addition also possesses synergistic activity when administered along with other oral nonsteroidal anti-inflammatory drugs, such as acetaminophen and gabapentin, hence reducing the requirement of the systemic agents.⁹ Previous studies have shown that significant pain relief was obtained when intra-articular ketorolac was given along with bupivacaine and epinephrine as a cocktail injection.^{5,11,13}

Badner et al stated the addition of an opioid like morphine in the cocktail injection did not provide any significant additional advantage when compared to cocktail mixtures without opioids with regard to postoperative pain relief.¹⁴ In concurrence with that study, our study also excluded the use of opioids in the cocktail injection.

Christensen et al stated the addition of steroids to multimodal peri-articular cocktail injection only helped in minimizing the length of hospital stay. It neither improves pain relief nor early postoperative range of movement. Instead they also posed an increased risk of postoperative infection and patellar tendon rupture.^{14,16,17} Hence, steroids were not added to the cocktail injection in our study.

Badner et al administered a combination of bupivacaine and epinephrine in the cocktail injection.¹⁴ Mullaji et al administered bupivacaine, fentanyl, methylprednisolone, and cefuroxime.¹⁸ Andersen et al administered subcutaneous Ropivacaine.¹⁹ Vaishya et al administered bupivacaine, adrenaline, morphine, ketorolac, and gentamycin. All of them had shown significant pain relief, increased early postoperative knee range of movements and quadriceps function.²⁰

Busch et al stated that patients who received a peri-articular intraoperative injection containing ropivacaine, ketorolac, epimorphine, and epinephrine significantly used less patient controlled analgesia (PCA) during the first 24 hours after surgery.¹¹ Vaishya et al stated in their study comparing 2 groups of 40 knees each had reported that the cocktail injected patients had significantly used less patient controlled analgesia (PCA) after 6, 24, 48, and 72 hours after TKR.²⁰

Dalury et al stated that the goal is to deliver as much of the fluid as possible into the tissues, so as to increase its effectiveness. Using smaller needles (22 gauge) is ideal and using control syringes (that allow aspiration before injection and are more comfortable for the hand) aid while injecting in areas of potential danger.⁹ In our study, we had used a 22 gauge needle and a 50 ml conventional syringe for administration of cocktail injection in the five anatomical zones.

Nakai et al stated that postoperative nausea and vomiting were the least observed complication in the peri-articular injection group compared with the other 2 groups where no injection or intra-articular injection was used.²¹ Femoral nerve block and epidural anesthesia have been reported to significantly control pain with good efficacy. However, these procedures always require a well-trained physician, and there are some severe complications that could eventually result from these procedures. Sharma et al reported that the rate of femoral neuropathy after femoral nerve block was found to be 0.59% approximately.²² Vendittoli et al stated that peri-articular cocktail injection with ropivacaine, ketorolac, and adrenaline on the first postoperative day showed a reduction in narcotic requirements at 48 hours postoperatively with minimal side effects in comparison with the control group.²³ Jacob West et al in 2019 performed a study to evaluate clinical outcomes in patients after total knee arthroplasty and found an increase in KSS score in his patients. Similarly, in our study there was significant improvement of Knee Clinical Score and Knee Functional Score following TKA.²⁴

Limitation

There was no comparison group in our study to assess the efficiency of peri-articular cocktail injection.

CONCLUSION

In conclusion, intraoperative periarticular injection with 20 ml of 0.5% ropivacaine, 1 ml of ketorolac, 1 ml of clonidine and 0.5 ml noradrenaline diluted in 20 ml of saline is effective in reducing immediate post-operative pain and thereby improving the overall functional outcome.

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Ethical approval: Not required

REFERENCES

1. Rosal MC, Ayers D, Li W. A randomised clinical trial of a peri-operative behavioural intervention to improve physical activity adherence and functional outcomes following total knee replacement. *BMC musculoskeletal Disord*. 2011;12:226.
2. Fu P, Wu H, Li X, Qian Q, Zhu Y. Efficacy of intra-articular cocktail analgesic injection in total knee arthroplasty - a randomised controlled trial. *Knee*. 2009;16(4):280.
3. Parvataneni HK, Shah VP, Howard H. Controlling pain after total hip and knee arthroplasty using a multimodal protocol with local periarticular injections: A prospective randomised study. *Journal of arthroplasty*. 2007;22(2):33-8.
4. Galimba J. Promoting the use of periarticular multimodal drug injection for total knee arthroplasty. *Orthop Nurs*. 2009;28(5):250.

5. Fajardo M, Collins J, Landa J, Adler E, Meere P, Di Cesare PE. Effect of a peri-operative intra-articular injection on pain control and early range of motion following bilateral TKA. *Orthopedics*. 2011;34(5):e33.
6. Yuenyongviwat V, Pornrattanamanee Wong C, Chinachoti T, Chareancholvanich K. Periarticular injection with bupivacaine for post-operative pain control in total knee replacement: a prospective randomized double-blind controlled trial. *Adv Orthop*. 2012;2012:107309.
7. DeWeese FT, Akbari Z, Carline E. Pain control after knee arthroplasty: intra-articular versus epidural anesthesia. *Clin Orthop Relat Res*. 2001;392:226-31.
8. DaGuo, Xue-Wei C, Jin-Wen L, Wen-Wei O, Jian-Ke P, Jun L. Continuous intra-articular infusion anaesthesia for pain control after total knee arthroplasty: Study protocol for a randomised control trial.
9. Dalury DF. A state-of-the-art pain protocol for total knee replacement. *Arthroplasty Today*. 2016;2(1):23.
10. Nuelle DG, Mann K. Minimal incision protocols for anesthesia, pain management, and physical therapy with standard incisions in hip and knee arthroplasties: The effect on early outcomes. *Journal of Arthroplasty*. 2007;22(1):20-5.
11. Busch CA, Shore BJ, Bhandari R. Efficacy of periarticular multimodal drug injection in total knee arthroplasty: a randomized trial. *J Bone Joint Surg Am*. 2006;88(5):959.
12. Ng FY, Ng JK, Chiu KY, Yan CH, Chan CW. Multimodal periarticular injection vs continuous femoral nerve block after total knee arthroplasty: a prospective, crossover, randomized clinical trial. *J Arthroplasty*. 2012;27(6):1234.
13. Kelley TC, Adams MJ, Mulliken BD, Dalury DF. Efficacy of multimodal perioperative analgesia protocol with periarticular medication injection in total knee arthroplasty: a randomized, double-blinded study. *J Arthroplasty*. 2013;28(8):1274.
14. Badner NH, Bourne RB, Rorabeck CH, MacDonald SJ, Doyle JA. Intra-articular injection of bupivacaine in knee-replacement operations. Results of use for analgesia and for preemptive blockade. *J Bone Joint Surg Am*. 1996;78(5):734.
15. Ritter MA, Koehler M, Keating EM, Faris PM, Meding JB. Intra-articular morphine and/or bupivacaine after total knee replacement. *J Bone Joint Surg Br*. 1999;81(2):301.
16. Christensen CP, Jacobs CA, Jennings HR. Effect of periarticular corticosteroid injections during total knee arthroplasty: a double-blind randomized trial. *J Bone Joint Surg Am*. 2009;91(11):2550.
17. Hernandez-Palazon J. Infiltration of the surgical wound with local anesthetic for postoperative analgesia in patients operated on for lumbar disc herniation. Comparative study of ropivacaine and bupivacaine. *Rev Esp Anesthesiol Reanim*. 2001;48(1):17.
18. Mullaji A, Kanna R, Shetty GM, Chavda V, Singh DP. Efficacy of periarticular injection of bupivacaine, fentanyl, and methylprednisolone in total knee arthroplasty: a prospective, randomized trial. *J Arthroplasty*. 2010;25(6):851.
19. Andersen LØ, Husted H, Kristensen BB, Otte KS, Gaarn-Larsen L, Kehlet H. Analgesic efficacy of subcutaneous local anaesthetic wound infiltration in bilateral knee arthroplasty: a randomised, placebo-controlled, double-blind trial. *Acta Anaesthesiol Scand*. 2010;54(5):543.
20. Vaishya R, Wani AM, Vijay V. Local infiltration analgesia reduces pain and hospital stay after primary TKA: randomized controlled double blind trial. *Acta Orthop Belg*. 2015;81(4):720.
21. Nakai T, Tamaki M, Nakamura T, Nakai T, Onishi A, Hashimoto K. Controlling pain after total knee arthroplasty using a multimodal protocol with local periarticular injections. *J Orthop*. 2013;10(2):92.
22. Sharma S, Iorio R, Specht LM, Davies-Lepie S, Healy WL. Complications of femoral nerve block for total knee arthroplasty. *Clin Orthop Relat Res*. 2010;468(1):135.
23. Vendittoli PA, Makinen P, Drolet P. A multimodal analgesia protocol for total knee arthroplasty: a randomized, controlled study. *J Bone Joint Surg Am*. 2006;88(2):282.
24. West JA, Scudday T, Anderson S, Amin NH. Clinical outcomes and patient satisfaction after total knee arthroplasty: a follow-up of the first 50 cases by a single surgeon. *J Int Med Res*. 2019;47(4):1667-76.

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