

## Update on Post-Operative Analgesia in Total Knee Replacement

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### Abstract

Achieving optimal pain control following TKA remains a challenge, given its subjective nature and patient variability. As a result, it is difficult to devise a “one fits all” analgesic regimen. In this analysis, we viewed the use and efficacy of different modes of perioperative analgesia. The purpose of this review is to present the new protocols and classic strategies for the management of pain in the post-operated patient of total knee replacement as well as the multimodal analgesia regimen which has been widely used in recent years.

**Keywords:** knee; analgesia; replacement; arthroplasty

## Introduction

Amy et al 2017 [1] mentioned that elective total knee arthroplasty (TKA) is the gold standard for management of arthritis-associated pain and disability in osteoarthritis patients who have failed nonoperative treatment modalities. According to the American Academy of Orthopedic Surgeons (AAOS), this procedure provides pain relief and improves function but may result in complications such as pain, infection, and venothromboembolic disease. Following TKA, patients experience severe pain mediated by multiple pathways, necessitating comprehensive postoperative pain control. Compared with patient-controlled intravenous (IV) opioids alone, multimodal analgesia may facilitate rehabilitation and allow faster progression of physical therapy. Multimodal analgesia, which is the use of at least 2 agents with differing mechanisms for pain control, has been shown to reduce hospital length of stay by 1.2 days and rehabilitation length of stay by 10 to 13 days compared with traditional postoperative analgesia. When managing patients' pain, organizations may utilize both nonpharmacological and pharmacological strategies, which often include opioid analgesics and adjuvant modalities. The purpose of this review is to present the new protocols and classic strategies for the management of pain in the post-operated patient of total knee replacement as well as the multimodal analgesia regimen which has been widely used in recent years.

Randa et al 2017 [2] established that as surgical techniques and pharmacology advance, the management of postoperative pain in patients undergoing TKA continues to evolve. The current standards of care are composed of multimodal pain management, including opioids, non-steroidal anti-inflammatory drugs and gabapentinoids, peripheral nerve blocks and periarticular injections.

David et al 2017 [3] said that one of the major challenges to TKA is optimal pain control. Effective analgesia is capital in fast-track surgery programs to allow patient's early functional outcomes.

### Analgesic medications

Randa et al 2017 [2] affirmed that analgesics are often the mainstay of treatment in the immediate postoperative period in the short term. Despite the effectiveness of opioids, they often produce undesirable side effects, such as vomiting, constipation, confusion, and respiratory depression, which has led to a shift to alternative and multimodal analgesic regimens, such as ac-

etaminophen, scheduled nonsteroidal anti-inflammatory drugs (NSAIDs) which are cyclo-oxygenase 2 enzyme inhibitors, and neuroleptic agents. (gabapentin and pregabalin), as part of the preventive or postoperative treatment of pain.

Amy et al 2017 [1] observed that to optimize analgesic efficacy and minimize opioid-related adverse effects, the AAOS and American Society of Anesthesiologists Task Force on Acute Pain Management recommend multimodal pain management for TKA pain and surgical pain, respectively. This includes use of NSAIDs, or acetaminophen in addition to opioid analgesics. Local anesthetics for regional nerve block may also be considered. Continuous infusion (CI) NSAID administration is one strategy that has been shown to reduce opioid consumption in major and minor orthopedic procedures.

Amy et al 2017 [1] affirmed that Ketorolac IC offers a viable analgesic treatment modality to minimize the use of opioids and the risks associated with opioid therapy.

Amy et al 2017 [1] found that the previous clinical trials have demonstrated benefit with the addition of continuous infusion (CI) ketorolac to a multimodal pain regimen in surgical patients. CI ketorolac for postoperative pain management of unilateral TKA demonstrated a reduction in pain scores and opioid consumption with similar safety outcomes compared with a traditional opioid-based protocol. CI of ketorolac is a measure to reduce opioid consumption.

### Periarticular injections

Sachiyuki et al 2018 [4] said periarticular injection for TKA consists of superficial injection and deep injection. Multi-drug solution is injected into the extensor mechanism, pes anserinus, and anteromedial capsule as superficial injection, and into the posterior capsule, posteromedial structures, and periarticular synovium as deep injection. In TKA managed with spinal anesthesia, both injections have been performed in the late stage of surgery; deep injection has been performed just before implantation and superficial injection just after implantation. The concept of pre-emptive analgesia, in which analgesic intervention prior to the onset of noxious stimuli could reduce postoperative pain and opioid consumption, has been advocated. To achieve pre-emptive analgesia, earlier analgesic intervention using periarticular injection may be associated with a better pain relief than the conventional technique of periarticular injection.

Sachiyuki et al 2018 [4] conducted a study to determine whether periarticular injection performed in the early

stage of TKA, could provide a better postoperative pain relief than periarticular injection performed in the late stage of TKA. Multimodal pain management has become standard practice to resolve severe pain after TKA. Periarticular injection is one of the most critical components of the multimodal pain management. There has been a great deal of interest in effective techniques for periarticular injection. Randa et al 2017 [2] observed that periarticular injections of delayed-release anesthetics can help improve pain management.

Sachiyuki et al 2018 [4] observed that the most important finding of this study was that periarticular injection performed in the early stage of surgery reduced postoperative pain at the recovery room compared with periarticular injection performed in the late stage of surgery during TKA managed under general anesthesia without regional block. The effect size fulfilled the MCID. The statistically significant and clinically important difference in the improvement of postoperative pain was observed only at recovery room. This short-term difference would be beneficial for patients, because this improvement required only the timing of periarticular injection to be brought forward. The previous studies indicated that periarticular injection including ropivacaine, morphine, methylprednisolone, ketoprofen, and epinephrine provided more long-term pain relief. Superficial injection just prior to arthrotomy provided clinically meaningful improvement in pain following TKA managed under general anesthesia without regional block and a modest decrease in intraoperative blood loss compared with superficial injection after completing total knee prosthesis implantation.

### Peripheral nerve block

David et al 2017 [3] basing on his clinical impression, he think that local infiltration (LIA) may be a good adjuvant to femoral nerve block (FNB) in postoperative care. This study was established to investigate if this combined administration (femoral block and LIA) offered any real advantage in terms of optimal pain control, faster rehabilitation (and then discharge), and higher patients' satisfaction.

David et al 2017 [3] said these principles, applied to TKA, resulted in improvements in multimodal opioid regimens including LIA technique and peripheral nerve blocks. The ultimate goal is to facilitate early mobilization and function gain, finally leading to a reduction of length of stay (LOS) and improvements in overall surgical outcomes.

David et al 2017 [3] affirmed that is a safe adjuvant to FNB reduce perioperative pain during the first 36 h after TKA.

Its effects wean with time, but do cover the first crucial hours of rehabilitation in a fast-track program. LIA seems don't modify postoperative course nor patient's satisfaction at short-term follow-up. The final impact of LIA on surgical outcome is still to be determined. Further studies are still needed to link patient's pain with increased collaboration with physical therapy and improved overall clinical results.

LIA or peripheral block is the mainstay of multimodal analgesia being these options the most used worldwide however there are still some centers where they are not carried out due to economic possibilities [5].

Randa et al 2017 [3] expressed that periarticular injections have been shown to be effective with a remarkably favorable side effect profile. The use of liposomal bupivacaine and / or its mixtures with bupivacaine is likely to play an increasingly important role in the treatment of interventional pain. There is a predictable positive correlation between adequate pain management and postoperative recovery and rehabilitation, and a multimodal perioperative protocol with periarticular or perineural injections appears, the most effective method. Currently, research is being conducted on the efficacy and safety of liposomal bupivacaine in peripheral nerve blocks, with available data demonstrating significant promising advantages for achieving prolonged postoperative analgesia [6].

### Physical means

Yongjun et al 2017 [7] established that the transcutaneous electrical nerve stimulation (TENS) is a possible adjunctive therapy to pharmacological treatment for controlling pain after total knee arthroplasty. TENS supplementation intervention was found to significantly reduce VAS scores and total postoperative morphine dose over a period of 24 h, and to improve active range of knee motion. However, rehabilitation exercises (e.g. flexion/extension of the knee) can be very painful and severe pain may lead to poor functional recovery. Pharmacological treatment is ineffective for controlling severe pain during rehabilitation.

Yongjun et al 2017 [7] mentioned that TENS is reported to be efficacious for better pain management when used as a supplement to pharmacological analgesia during rehabilitation exercises. Both the peripheral and the central nervous systems are involved in the analgesic action of TENS through activating endogenous inhibitory mechanisms of opioid receptors in the central nervous system, and reducing central neurone sensitization and primary and secondary mechanical hyperalgesia. Previous studies have shown that TENS can reduce postop-

erative movement pain after various surgeries. TENS has been reported to have important capability for pain relief and functional recovery after TKA [8].

Yongjun et al 2017 [7] said TENS supplementation intervention was associated with a significantly reduced VAS scores and total postoperative morphine dose at 24 h, but had no influence on VAS scores at 2 weeks. This indicates that TENS supplementation could substantially promote immediate pain relief following TKA, but has no effect on pain control over a relatively long follow-up after TKA. This may be due to pain intensity remaining at a low level over the follow-up. Furthermore, this low-intensity pain may not affect the functional performance of knee movement exercise and the quality of life of patients.

## Conclusions

Achieving optimal pain control following TKA remains a challenge, given its subjective nature and patient variability. As a result, it is difficult to devise a “one fits all” analgesic regimen. In this analysis, we viewed the use and efficacy of different modes of perioperative analgesia. Periarticular injections have shown to be efficacious with a remarkably favorable side-effect profile. There is a predictable positive correlation between adequate pain management and postsurgical recovery and rehabilitation, and a multimodal perioperative protocol with periarticular or perineural injections appears to be the most efficacious method. The use of liposomal bupivacaine and/or its mixtures with bupivacaine is likely to play an increasingly important role in interventional pain management. As well as TENS supplementation intervention showed an important ability to reduce immediate pain after TKA and facilitated the recovery of knee function.

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