

Guidelines for the Management of Postoperative Pain after Total Knee Arthroplasty

Korean Knee Society

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This clinical practice guideline was approved by Korean Knee Society on February 28, 2012. It is based on a systematic review of published studies on the management of postoperative pain after total knee arthroplasty and was developed to include the overall pain management modalities. The purpose of the guideline is to help improve treatment based on current best evidence. Eleven recommendations have been developed based on a systematic review of research evidence and the consensus opinions of a multidisciplinary working group of experts. These recommendations will be revised regularly following systematic review of new research evidence as this becomes available.

Key words: Postoperative pain management, Total knee arthroplasty, Guidelines.

Introduction

Despite the increasing interest in postoperative pain management and development of pain control modalities, more than half of the patients who undergo surgery experience inappropriate level of postoperative pain¹⁻⁴. In particular, pain after orthopedic surgery has been considered especially difficult to manage⁴⁻⁸. Approximately half of total knee arthroplasty (TKA) patients present with extreme pain immediately after surgery^{1,2,9-11}.

Therefore, "immediate postoperative pain" is top on the list of concerns for TKA candidates¹², which often results in a delay or cancellation of the surgical intervention¹³.

Severe postoperative pain after TKA can not only be a patient

suffering but also negatively affect postoperative recovery. Extensive tissue damage in major operations, such as TKA, cause immediate changes in the endocrine system and central, peripheral, and sympathetic nervous systems, and stimulate catabolic hormone release including cortisol, glucagon, growth hormone, and catecholamine, resulting in compromised immunity, increased oxygen demand, and higher strain on the cardiovascular system¹¹. If severe postoperative pain is managed inadequately under these circumstances, the surgery-induced responses can be exacerbated, posing a serious danger to patients.

Specifically, severe postoperative pain has been associated with serious complications including ischemic cardiac events and myocardial insufficiency that result from increased stress on the cardiovascular system¹⁴. In addition, immobilization caused by pain may increase the risk of decreased pulmonary function¹⁵, gastrointestinal complications, such as ileus¹⁶, and thrombus formation that are related to surgical stress. An increase in stress hormone and sleep disorder due to severe pain can worsen the already decreased immunity, which leads to higher risk of infection. In particular, this may affect the mental status of elderly patients, causing delirium or anxiety disorder^{8-11,17}. Uncontrolled severe immediate postoperative pain can develop into chronic pain due to the sensitization of the nerve system^{17,18}. Accordingly, early rehabilitation and recovery can be delayed, resulting in longer hospitalization, higher medical costs, and more burden on the health care provider^{1,2,8-11,14,15,19,20}. Pain after TKA is a particularly serious problem, considering the substantially increasing TKA use and the aging population.

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Therefore, proper management of pain after TKA is not just for the humane purpose of freeing patients from suffering. Rather, it is essential for successful TKA outcome in terms of improving patient satisfaction and quality of life and prevention of complications. The most important concept of current pain management following TKA is the preemptive use of multimodal approach. “Preemptive” refers to initiate pain management before surgical stimuli. In addition, “multimodal approach” means more than 2 drugs or modalities with different mechanisms or sites for synergistic effects. These two concepts have also been known to be remarkably effective for reducing the opioid consumption that has been associated with high complication rates.

Postoperative Pain Management Guidelines for TKA

The followings are the recommended modalities for the management of postoperative pain after TKA.

- 1) Patient education
- 2) Administration of preemptive analgesics
- 3) Neuraxial analgesia: epidural analgesia
- 4) Peripheral nerve block: femoral nerve block
- 5) Periarticular injection
- 6) Patient-controlled analgesia (PCA)
- 7) Oral analgesics

Pain Management Methods

We assigned a grade of recommendation of A, B, C, or I to each pain management method based on the review of the literature.

A (Recommended): Good evidence (Level I Studies [high quality randomized trial or systematic review of Level I studies] with consistent findings) for or against recommending intervention.

B (Effective): Fair evidence (Level II or III Studies [prospective or retrospective comparative study, case control study, or systematic review of level II or III study] with consistent findings) for or against recommending intervention.

C (Worth consideration): Poor quality evidence (Level IV or V Studies [case series or expert opinion]) for or against recommending intervention.

I (Inconclusive): Insufficient or conflicting evidence not allowing a recommendation for or against intervention.

1. Basic Concepts

1) Recommendation 1.1): Preemptive pain management

It is recommended to preemptively perform drug administration or other modalities for postoperative pain management prior to surgical incision.

Level of evidence: I, II

Grade of recommendation: A

Rationale for recommendation 1.1)

Preemptive use of pain control drugs (opioids^{21,22}, non-steroidal anti-inflammatory drugs [NSAIDs], cyclo-oxygenase [COX]-2 inhibitors^{23,24}, and pregablin²⁵⁻²⁸) or pain management procedures (regional anesthesia^{29,30} and peripheral nerve block³¹) can be effective in reducing central & peripheral sensitization and postoperative pain level, which results in decreased consumption of the analgesic agents after surgery^{8-10,19,32}. Preemptive pain management drugs should be orally administered with water or injected approximately 1 hour before surgery.

2) Recommendation 1.2): Multimodal pain management

It is recommended to use more than two agents or modalities with different mechanisms that act at different sites for multimodal pain management.

Level of evidence: I, II

Grade of recommendation: A

Rationale for recommendation 1.2)

A combined use of drugs or procedures that have different mechanisms of action can be more effective in improving pain and reducing the consumption of each agent. In particular, the opioid sparing effect would result in less complications^{8-10,19,23,33,34}.

2. Preoperative Period

1) Recommendation 2.1): Preoperative patient education

Preoperative education should be provided for patients and their family members before TKA. The content should include the overall surgical procedure and rehabilitation protocol, expected benefits of the procedure, postoperative pain level and pattern, and pain management methods. The effectiveness of the education can be improved through personal interviews or presentation sessions, or with use of educational media such as videos.

Level of Evidence: I, V

Grade of Recommendation: C

Rationale for Recommendation 2.1)

Preoperative education can be helpful in easing patient's fears about the procedure and providing a realistic picture of the possible outcomes, which would increase patient satisfaction and

shorten hospitalization and rehabilitation period^{9,35-37}).

2) Recommendation 2.2): Preemptive use of opioids

Oral administration of opioids before surgery is effective for postoperative pain management.

Level of Evidence: I, II, III

Grade of Recommendation: B

Rationale for Recommendation 2.2)

Preoperative oral administration of opioids can be helpful for managing postoperative pain and reducing the use of opioid, but its influence on the occurrence of opiate side effects has not been established²¹. In a randomized study by Cheville et al.²², preemptive use of opioids in patients with TKA prior to rehabilitation improved pain control, accelerated functional recovery, and reduced the number of rehabilitation sessions. Although slow-release oxycodone has been the most commonly used narcotic for preemptive pain control, there is an increasing trend to exclude opioids from preemptive pain management protocol due to the risk of complications such as nausea and vomiting.

3) Recommendation 2.3): Preemptive use of COX-2 inhibitors

Preoperative oral administration of COX-2 inhibitors is recommended.

Level of Evidence: I

Grade of Recommendation: A

Rationale for Recommendation 2.3)

Preoperative oral administration of a COX-2 inhibitor can facilitate pain relief, reduce the need for opioids and related complications, and improve patient satisfaction. Furthermore, the efficacy and safety of COX-2 inhibitors for postoperative pain management have been well established^{11,23,35,38}. Non-selective NSAIDs that are expected to produce similar pain relieving effects enhances the risk of hemorrhage and upper gastrointestinal side effects. Accordingly, COX-2 inhibitors are recommended for preemptive pain management and celecoxib is the only available COX-2 inhibitor in Korea.

4) Recommendation 2.4) Preemptive use of gabapentin or pregabalin

The efficacy of preoperative oral administration of gabapentin or pregabalin has yet to be established.

Level of Evidence: I, V

Grade of Recommendation: I

Rationale for Recommendation 2.4)

Preoperative oral administration of gabapentin or pregabalin

reduces postoperative pain and opioid consumption, and provides synergistic effects when used in combination with a COX-2 inhibitor after obstetric and gynecologic operations or spinal fusion²⁵⁻²⁸. Although it appears to produce similar results in TKA, its efficacy should be determined in further studies.

3. Intraoperative Period

1) Recommendation 3.1): Use of regional anesthesia

Regional anesthesia either spinal or epidural is recommend over general anesthesia in the absence of specific contraindications such as coagulopathy.

Level of Evidence: I

Grade of Recommendation: A

Rationale for Recommendation 3.1)

Regional anesthesia lowers systolic pressure, reducing intraoperative hemorrhage, frequency of nausea and vomiting after surgery, and pulmonary and cardiovascular complications. It provides excellent pain relief and improves patient satisfaction^{8-10,39-42}. Furthermore, epidural anesthesia allows for continuous infusion of pain medications via a catheter. However, care should be taken to interrupt deep venous thrombosis prophylaxis until 12 hours after epidural catheter removal due the risk of epidural hematoma and paraplegia following hemorrhage.

2) Recommendation 3.2): Use of peripheral nerve block

A peripheral nerve block such as femoral nerve block and sciatic nerve block is an effective adjuvant for pain management.

Level of Evidence: I, II, III

Grade of Recommendation: B

Rationale for Recommendation 3.2)

A peripheral nerve block can be performed with a single-injection or continuous infusion via a catheter. Femoral nerve blocks are as effective as epidural anesthesia in pain relief^{33,43,44} and single peripheral nerve block is advantageous for avoiding side effects associated with epidural analgesia, improving rehabilitation, and reducing hospital stay⁴⁵⁻⁴⁷. These benefits are enhanced when it is used in conjunction with epidural analgesia⁴⁸. However, caution has been advised with the use of continuous femoral nerve block because it has been associated with quadriceps femoris weakness, increased risk of falling after TKA, and compromised proprioception such as femoral neuritis⁴⁹⁻⁵².

3) Recommendation 3.3): Use of periarticular multimodal drug injection

Intraoperative periarticular multimodal drug injection using

opioids and long-acting local anesthetic agents is effective for postoperative pain management.

Level of Evidence: I, II, III

Grade of Recommendation: B

Rationale for Recommendation 3.3)

Periarticular multimodal drug injection significantly reduces pain without any complications, such as infection^{9,20,53-55} and produces additional pain relieving effects when incorporated into multimodal pain control protocols⁵⁶⁻⁵⁹. However, the proper dosage and composition of injection cocktail and injection techniques have not been established and there is disagreement over its influence on reduced opioid consumption. Its efficacy is limited in time and patients should be informed on the occurrence of rebound pain after half-life of the treatment agents. The most commonly used drugs for periarticular injections include local anesthetics, such as bupivacaine and ropivacaine, morphine, ketololac, clonidine, and steroids. Epinephrine is often combined to prolong the effect and antibiotics, such as cefuroxime, to reduce the risk of infection. Steroids are advantageous for lengthening the duration of action of the periarticular injection, but rarely used in patients with high infection risks, such as diabetes or advanced age.

4. Postoperative Period

1) Recommendation 4.1): Use of Intravenous patient-controlled analgesia (IV-PCA)

IV-PCA is useful for postoperative pain management.

Level of Evidence: I, II, III

Grade of Recommendation: B

Rationale for Recommendation 4.1)

IV-PCA is the most common postoperative pain management modality that offers excellent analgesia with reduced rescue injection and analgesic drugs and improves patient satisfaction^{60,61}. However, inappropriate selection of equipment or analgesics may result in detrimental effects. In addition, IV-PCA should be used with extreme care in patients with advanced age due to the risk of opioid-related side effects including nausea and vomiting, respiratory or urinary failure, constipation, and pruritus^{8,62}.

2) Recommendation 4.2): Use of multimodal oral analgesics after TKA

Multimodal oral pain regimens are recommended for postoperative pain management.

Level of Evidence: I

Grade of Recommendation: A

Rationale for Recommendation 4.2)

It is recommended to use multimodal oral pain regimens when oral administration becomes possible after surgery. The combined use of analgesics with different mechanisms of action produces synergistic effects such as maximum pain relief and reduced opioid consumption, which results in fewer complications and higher patient satisfaction^{8-10,19,63}. The commonly administered analgesics for pain after TKA include acetaminophen, COX-2 inhibitors, tramadol, and oxycontin. In contrast to the preemptive pain management modalities, postoperative methods employ short-acting opioids at frequent intervals for rapid pain relief and prompt management of complications.

Conclusions

Preemptive use of multimodal pain management approaches is currently recommended for postoperative pain control in TKA. Among a variety of pain management modalities that are available, a combined use of some modalities which were based on the assessment of advantages and disadvantages of each method, surgeon's techniques, and its own institution condition, would provide better surgical outcomes in terms of pain relief, systemic complication rate, early rehabilitation, patient satisfaction, and quality of life.

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