Opioid-Free Total Knee Arthroplasty? Local Infiltration Analgesia Plus Multimodal Blood-Loss Prevention Make it Possible

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Received: 30 June 2018/Accepted: 13 September 2018/Published online: 15 October 2018
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Abstract Opioids have been widely used in the USA for pain control after total knee arthroplasty (TKA). However, adverse effects, especially the possibility of addiction, have increased interest in opioid-free pain management after surgery. We therefore sought to review current pain management protocols after TKA, focusing especially on opioid-free alternatives. We reviewed the literature on pain management after TKA using Medline (PubMed), through June 30, 2018, using the keywords “TKA” and “analgesia.” We found 388 articles but chose to analyze the 34 that presented high-quality (levels I and II) evidence. Local infiltration analgesia (LIA) is a good option for reducing the use of post-operative opioids; many reports have compared LIA against a nerve block or studied the synergies between two protocols of loco-regional anesthesia. Multimodal blood-loss prevention is sometimes recommended in combination with opioid-free analgesia. In most studies, however, no differences are reported or contradictory results exist. Post-operative pain management protocols vary so much that it is difficult to strongly favor a determined pathway.

Keywords knee · total knee arthroplasty · post-operative pain · opioids · local infiltration analgesia · opioid-free TKA

Total knee arthroplasty (TKA) is one of the most frequently performed orthopedic procedures. In the USA, the rate of TKA is 235/100,000 population [7], representing about 9% of total inpatient stays.

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s11420-018-9636-2>) contains supplementary material, which is available to authorized users.

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Several advances have been developed to facilitate early discharge after TKA, and many hospitals have implemented “fast-track” protocols. While strategies focused on reducing intra- and post-operative bleeding facilitate patient recovery and diminish the rate of post-operative transfusions [25], improvements in post-operative pain management during the last decade, including multimodal interventions, have also facilitated TKA recovery. Combined anesthesia protocols (i.e., general or epidural anesthesia plus peripheral nerve blocks), regional anesthesia (i.e., intradural), and local infiltration analgesia (LIA) protocols have provided popular methods for decreasing pain and accelerating recovery after TKA. Nonetheless, opioids have been widely prescribed in the USA for control of knee pain both before and after TKA [8, 14, 19]. Consequently, adverse effects, especially the possibility of dependence and addiction associated with their use, have increased interest in non-opioid post-surgical pain management strategies [14, 19].

We decided to review the literature on pain control after TKA, especially regarding non-opioid alternatives. Is it possible to adequately manage pain after TKA without opioids? Is the LIA approach a valid alternative?

We searched Medline (PubMed) using the keywords “TKA” (total knee arthroplasty) and “analgesia,” through June 30, 2018. We retrieved 388 articles but analyzed only the 34 that provided grades I and II levels of evidence.

Almost all the studies retrieved reported that LIA can provide good pain control in the first 48 h after TKA. It usually is utilized as a part of a multimodal approach for post-operative pain management [9, 30, 31]. Different compositions of LIA have been used. Most studies include a local anesthetic (usually ropivacaine) combined with a corticosteroid (usually betamethasone) [2, 21]. Morphine, epinephrine, and antibiotics can also be added, but there is little evidence of their effectiveness [29].

LIA is typically employed to reduce post-operative opioid use [4, 11, 16, 22]. Many studies have compared LIA against a nerve block or have examined combined local and regional anesthesia protocols [3, 5, 10, 12, 13, 20, 27, 32–34]. Most show no differences, and contradictory results between studies exist. Post-operative pain management protocols vary so much that it is difficult to present evidence favoring a particular pathway.

LIA seems to be a good alternative to facilitate early rehabilitation on “fast-track” protocols, as its control of pain is especially important during the first 48 h [1, 5, 21, 22, 28]. Although differences between protocols at mid- to long-term follow-up have not been well-documented, LIA seems not to increase complications with wound healing or infection [15, 18]. LIA has been demonstrated to be a safe and useful alternative for ensuring early pain control, for avoiding motor blocks, and for reducing opioid usage. No major complications in the post-operative period have been found, although long-term functional outcomes should be studied.

In our surgical practice, we have used a single-dose LIA approach for almost 8 years [6, 17, 23–25]. Our cocktail consists of 50 cc of saline, epinephrine 300 µg, morphine sulfate 10 mg, tobramycin 100 mg, betamethasone sodium phosphate 6 mg, betamethasone acetate 6 mg, and ropivacaine 200 mg. We inject the total volume of 80 cc into the posterior capsule, collateral ligaments, pes anserinus, and patellar and quadriceps tendons after washing the bone surfaces and before definitive implantation.

All surgeries are performed using epidural anesthesia and a multimodal blood-loss prevention approach (MBLPA). MBLPA includes preoperative hemoglobin evaluation and optimization with intravenous iron in patients whose levels are under 13 g/dL. Hypotensive anesthesia and a tourniquet at 100 mmHg above the systolic pressure for the whole procedure are also included. Several technical tips, including plugging the femoral canal with autologous bone graft obtained from the femoral cuts, avoiding drains, and releasing the tourniquet after wound closure, are also used to minimize blood loss. Finally, tranexamic acid (TXA) has been used in two different protocols. One protocol includes intravenous TXA administered in two doses of 15 mg/kg in saline 100 cc 15 to 20 min before tourniquet release and 3 h later. The other protocol (and mostly used at this moment) includes intra-articular TXA administration (2 g in 20 cc of saline) after wound closure, without intravenous doses. Good results have been reported with such protocols in primary TKA, revision TKA, and hemophilic patients [17, 24–26].

Patients can move the knee from the first day and are usually discharged 2 days post-surgery walking with crutches. We use low-molecular-weight heparin (LMWH) for 4 weeks for thromboembolic prophylaxis. No opioids are used after the first day, and patients are discharged with oral analgesics (usually acetaminophen and nonsteroidal anti-inflammatory medications).

In conclusion, although opioids have been widely used for pain control following TKA, multiple level I and II studies have been published in recent years supporting the

use of LIA and MBLPA for improving pain control and accelerating recovery after TKA.

Compliance with Ethical Standards

Conflict of Interest: E. Carlos Rodríguez-Merchan, MD, PhD, Alfonso Vaquero-Picado, MD, FEBOT, and Juan S. Ruiz-Perez, MD, declare that they have no conflicts of interest.

Human/Animal Rights: N/A

Informed Consent: N/A

Required Author Forms: Disclosure forms provided by the authors are available with the online version of this article.

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