

PERIARTICULAR BUPIVACAINE INJECTION IN KNEE ARTHROPLASTY A RANDOMIZED

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ABSTRACT

Background: Different modes of analgesia have been reported for patients undergoing total knee arthroplasty. Postoperative analgesia with the use of parenteral opioids or epidural analgesia can be associated with side effects. Pain relief is important for postoperative knee rehabilitation, and it may influence the overall outcome, improves patient satisfaction, and may reduce the hospital stay. We investigated the analgesic effect of locally injected drugs around a total knee prosthesis.

Methods: Sixty-two patients undergoing total knee arthroplasty were randomized either to receive either (1) a perioperative infiltration mixture, consisting of local anesthetic, and Parenteral narcotics or (2) parenteral narcotics only. Pain control, narcotic consumption, medication side effects, and postoperative rehabilitation were monitored.

Results: The patients who had received the perioperative infiltration mixture used significantly less parenteral narcotic analgesia over the first twenty-four hours after the surgery. They had higher visual analog scores for patient satisfaction. Neither complications nor side effects related to the infiltration of the local anesthetic were observed.

Conclusions: Periarticular injection of a local anesthetic offered improved pain control and significantly reduce the requirements for parenteral narcotic analgesia with minimal side effects to patients undergoing total knee arthroplasty.

INTRODUCTION

Postoperative pain management is an important concern in the care of patients undergoing total knee arthroplasty. Adequate pain control has been shown to increase mobility¹⁻³, potentially decreasing the risk of deep venous thrombosis. Patient satisfaction is also increased with control of postoperative pain, promoting quicker recovery⁵.

Many modes of preoperative, perioperative, and postoperative analgesia have been reported. The use of narcotic drugs deals with postoperative pain efficiently but is often associated with side effects, including nausea and vomiting, respiratory depression, and urinary retention.

Epidural analgesia is of proven benefit but is associated with side effects such as severe headache, neurogenic bladder, hypotension and a risk of spinal infection^{4,5}.

Intraarticular injections of different analgesics following knee surgery with

minimal systemic side effects, is an attractive option. They have been shown to reduce requirements for postoperative analgesia¹⁻³.

We performed a prospective, blinded, randomized study to investigate the use of a periarticular injection of a long-acting local anesthetic (Bupivacaine), to provide analgesia following total knee arthroplasty.

MATERIALS AND METHODS

Sixty-two patients undergoing total knee arthroplasty were randomized. Thirty-two patients received an intraoperative periarticular injection of analgesic drugs, and thirty patients did not receive an intraoperative injection.

Exclusion criteria were: spinal or epidural anesthesia, simultaneous bilateral total knee arthroplasty, regular narcotic use, major psychological problems, renal insufficiency, abnormal liver enzymes, a history of stroke or a major neurological deficit.

Table I Demographic Data For Patients In The Study

	Group 1 (Infiltration)	Group 2 (No Infiltration)
Number of patients	32 patients	30 patients
Average age (range) (yr)	64 (55-74)	68 (55-76)
Gender	25 F, 7 M	22F, 8 M
Average hospital stay (d)	5	6
Wound complications (no.)	2	2
Deep vein thrombosis (at day 7) (no.)	0	0

Patients were randomly assigned to the two treatment groups: (1) Patients receiving perioperative infiltration mixture, consisting principally of local anesthetic, and Parenteral narcotics or (2) Patients receiving parenteral narcotics only.

Surgery

A standard medial parapatellar arthrotomy was used, and posterior stabilized components were fixed with cement. A vacuum drain was inserted before joint closure and was removed after 48 hours. All patients received a COX-2 inhibitor Mobic , 7.5 mg twice a day) and paracetamol (500 mg four times a day) regularly postoperatively. Low-molecular-weight heparin (Clexane), 40 mg subcutaneously daily for 14 days) was administered beginning on the night before surgery. All operations were performed with use of a tourniquet, which was inflated during draping and was released after skin closure. Patients were allowed to become mobile as tolerated beginning on the day of the surgery. daily isometric, passive, and active exercises were supervised by a senior physiotherapist.

The local infiltration mixture was prepared forty milliliters of 0.25 per cent bupivacaine after the prosthesis was implanted, two 20 - mL syringes, with a 22-gauge needle were used to infiltrate the deep tissues (collateral ligaments, posterior aspect of the capsule, quadriceps tendon, patellar tendon) with the mixture. A 16-gauge catheter that passed through the vastus lateralis muscle was inserted into the joint (for intra-articular injection on the day after the surgery). After wound closure, the rest of the **bupivacaine** was injected into the joint through the catheter.

On the first postoperative day (between sixteen and twenty-four hours after the surgery) 20 ml of **bupivacaine** 0.25% was injected into the knee through the 16-gauge catheter, and then the catheter was removed. The consumption of narcotics was measured at different time-points during the twenty-four-hour postoperative period and the patient's overall analgesic consumption was measured to allow for comparison of the two treatment groups. Patients used a visual analog scale to assess pain, as well as their satisfaction two to three weeks prior to the surgery, on the day of the surgery, in the

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post-anesthetic-care unit, during the inpatient stay, and finally at the six-week follow-up examination. The visual analog scales for pain and satisfaction ranged from 0 mm (indicating no pain) to 100 mm (indicating extreme pain) in 10-mm increments. Specific note was made of any signs of cardiac or central nervous system toxicity or wound complications. All patients had an ultrasound study of the lower

limb to screen for deep vein thrombosis at five days after the surgery.

RESULTS

Patients who had received the drug infiltration used significantly less analgesia at Four hours and at twelve hours and had a significantly lower overall requirement for analgesia over the first twenty-four hours after surgery compared with the patients who had received no infiltration (Fig. 1).

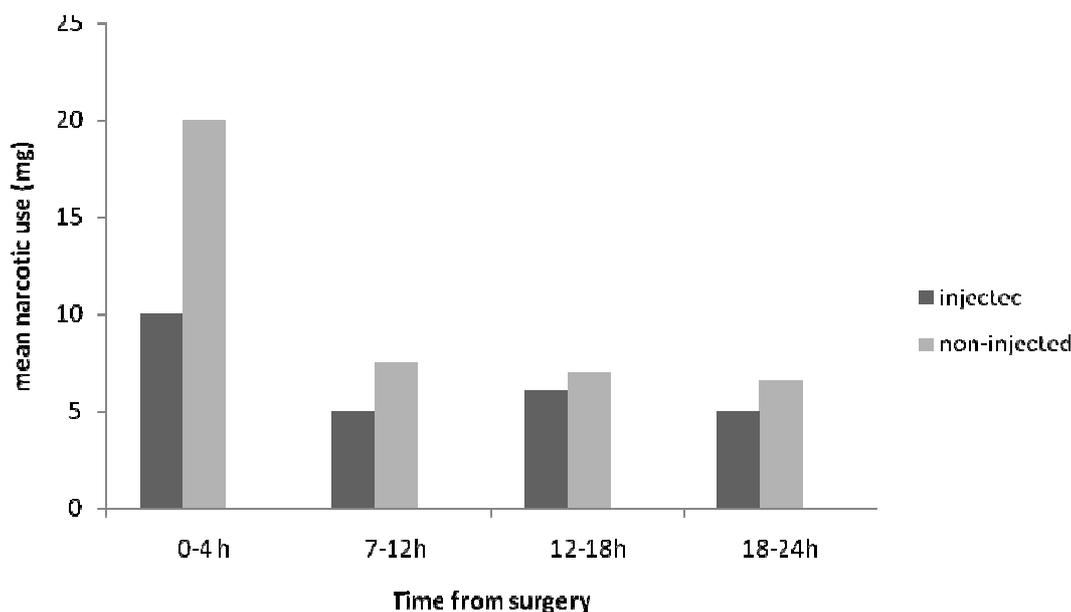


Fig. 1 Twenty-four-hour consumption of narcotics in milligrams.

The group that had had the infiltration had significantly greater mean visual analog scores for patient satisfaction in the post-anesthetic-care unit ($p = 0.016$) and four hours postoperatively ($p = 0.013$) (Fig. 2).

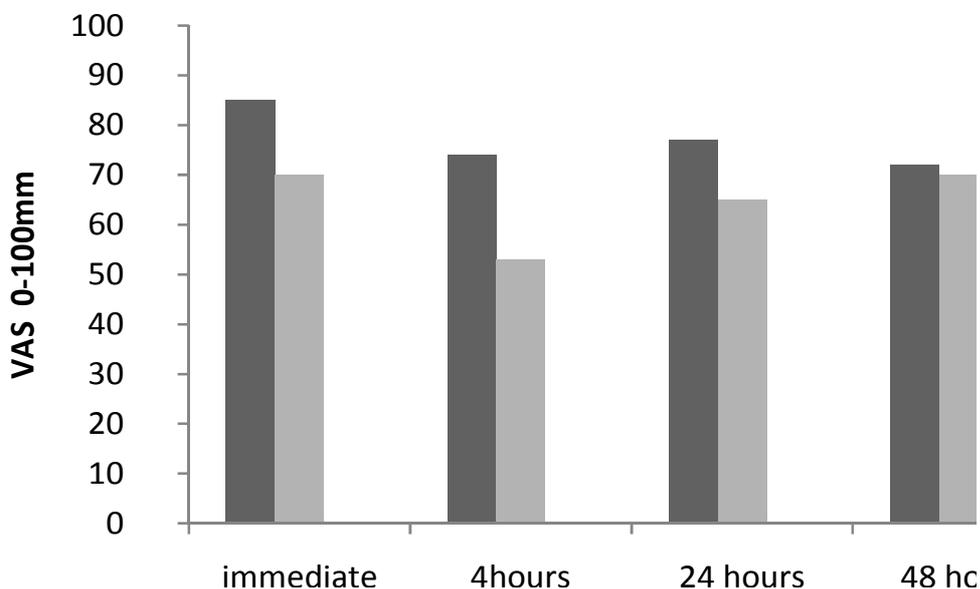


Fig. 2 Summary of visual analog scores (VAS) for patient satisfaction

At six weeks, no significant difference in the range of motion could be detected between the two groups. In addition, with the numbers available, there was no significant difference in the average hospital stay or the rate of wound complications between the two groups. One patient who had received the infiltration had a deep vein thrombosis postoperatively. No cardiac or central nervous system toxicity was observed ([Table I](#)).

DISCUSSION

Many protocols for post-operative pain control after total knee arthroplasty have been evaluated, none is optimal and narcotics still play a major role²⁻⁶. Although effective and reliable, narcotics are associated with side effects such as addiction, constipation, and respiratory depression.

The addition of continuous epidural infiltration has been demonstrated to be more effective than parenteral analgesia alone¹¹. However, epidural infiltration can be associated with side effects (nausea, pruritus, hypotension, urinary retention, poor muscle control, and delayed mobilization)^{6,11,12}. Moreover, the more serious complication as

epidural hematoma associated with VTE prophylaxis,^{10,11}.

The idea of administering analgesia directly to the operative site with minimal systemic side effects is an attractive option¹³. It causes peripheral sensitization by reducing the threshold for afferent nociceptive neurons, and it causes central sensitization by increasing the excitability of spinal neurons. Together these changes contribute to postoperative pain hypersensitivity, which increases the response to noxious stimuli and decreases the pain threshold at the site of the injured tissue as well as the surrounding uninjured tissue¹⁴.

In total joint arthroplasty, preemptive and multimodal approaches with use of Periarticular Bupivacaine Injection, and

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femoral nerve catheters have been shown to decrease narcotic use¹⁴.

The pharmacokinetics profile of Bupivacaine in epidural infiltration has shown up to ten hours of efficacy¹⁵. The addition of an intra-articular bolus injection on the first postoperative day most likely prolonged pain control and delayed pain rebound in our study. The intra-articular catheter could have been used for additional injections, but it carried the risk of contaminating the joint^{14,15}.

The primary objective of our study was to evaluate the safety and efficacy of a new perioperative intra-articular analgesia protocol. Bupivacaine is a long-acting analgesic with efficacy similar to that of Ropivacaine. We noted a significant reduction in the postoperative pain level ($p = 0.01$) during the first forty-eight hours after the surgery and a significant reduction of narcotics consumption that lasted for forty-eight hours ($p = 0.0003$). Many factors may explain the success of our protocol in comparison with that of the protocols used in other studies. Periarticular tissues were infiltrated under direct vision intraoperatively, providing a direct block of nerves that were injured or stretched at the time of the surgery. We also believe that entrapment of local anesthetics in the soft tissues improved the efficacy of the block and reduced the amount of medication discharged through the drain or the skin incision. Furthermore, injections of Bupivacaine were given both during the surgery and on the first postoperative day and the anesthetic doses were much higher than those used in other studies, in which the patients received single injections ranging from 50 to 200 mg of bupivacaine. The large dose of local anesthetic that we used appears to be safe, as no side effects were observed in our study group.

The advantages of this protocol include ease of use, low cost, and better operating-room efficiency. Operating time was not increased by the infiltration step, and this is a major advantage over peripheral nerve blocks, which may be time-consuming if they are performed in addition to spinal or general anesthesia in the same theater as the surgical procedure¹⁶.

In conclusion, intraoperative periarticular injection of multimodal drugs can significantly reduce requirements for patient-controlled analgesia and improve patient satisfaction, with no apparent risks, following total knee arthroplasty

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