

# Short-term Analgesic Effects of Intra-articular Injections After Knee Arthroscopy

Ryan C. Goodwin, M.D., Firooz Amjadi, M.D., and Richard D. Parker, M.D.

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**Purpose:** To study the effects of 3 different intra-articular analgesic combinations on postoperative pain, and whether the timing of the injection, either preoperative or postoperative, had an effect on postoperative analgesia. **Type of Study:** Prospective, randomized, double-blind clinical trial. **Methods:** Patients undergoing knee arthroscopy performed by a single surgeon under general anesthesia were randomized into 6 study groups. Each patient received an intra-articular injection 20 minutes before incision and at the end of the procedure. One injection contained the study medications, and the other contained normal saline solution (placebo). The patients, surgeon, and data collection personnel were blinded to the contents of the injections. Outcome measures included visual analogue pain scores at 0, 60, and 120 minutes after the procedure, and total recovery room fentanyl consumption. **Results:** Fifty patients successfully completed the study protocol. Patients receiving combinations of morphine, bupivacaine, and epinephrine or bupivacaine and epinephrine yielded lower pain scores and narcotics consumption than patients receiving epinephrine alone, which was statistically significant irrespective of the timing of injection ( $P < .0001$ ). Patients receiving the study medication preoperatively had significantly lower pain scores at the first measurement ( $t = 0$ ) than those receiving the study medication postoperatively ( $P = .0343$ ). There was no statistically significant effect of timing of the treatment medication administration at either 60 or 120 minutes postoperatively. Comparison of fentanyl consumption between groups receiving the treatment medication preoperatively versus postoperatively showed no significant difference. **Conclusions:** The combination of morphine, bupivacaine, and epinephrine, as well as the combination of bupivacaine and epinephrine provide excellent postoperative pain control when used either preoperatively or postoperatively in knee arthroscopy. There was a trend that patients receiving preoperative analgesic injections experienced superior pain control than did those injected postoperatively. **Level of Evidence:** Level I, Randomized Controlled Trial. **Key Words:** Pre-emptive—Analgesia—Knee—Postoperative—Pain.

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The perception of pain is a complex process that is not yet fully understood. With outpatient knee arthroscopy becoming the standard of care, postoperative pain management has become increasingly important in caring for patients.

Pre-emptive analgesia is the use of an anesthetic or

analgesic before surgery to reduce or eliminate subsequent pain.<sup>1</sup> It has been suggested that an amplified state of pain can be avoided or reduced with the use of pre-emptive analgesia by preventing a sensitized pain response to the injury.<sup>2</sup> Injection of the knee with anesthetics or analgesics before surgery may take advantage of this concept.<sup>3,4</sup>

Various substances have been injected into the knee in an attempt to control pain. While the use of anesthetics such as bupivacaine has been more popular, the use of intra-articular opiates has gained some attention.<sup>5</sup> It has been hypothesized that the presence of opioid receptors on some cells in the knee may provide an opportunity for blockade of pain outside the central nervous system with the use of intra-articular opiates.<sup>6</sup> The use of intra-articular epinephrine to con-

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*From the Departments of Orthopaedic Surgery, The Cleveland Clinic Foundation (R.C.G., R.D.P.), Cleveland, Ohio; and Cedars Sinai Medical Center (F.A.), Los Angeles, California, U.S.A.*

*Address correspondence and reprint requests to Richard D. Parker, M.D., Section of Sports Medicine, The Cleveland Clinic Foundation, Department of Orthopaedic Surgery, A41, 9500 Euclid Ave, Cleveland, OH 44195, U.S.A. E-mail: parkerr@ccf.org*

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trol bleeding in knee arthroscopy is fairly common, but its isolated effect on postoperative pain has not been studied. Furthermore, to our knowledge, there have been no studies that compared preoperative versus postoperative administration of various substances to see which regimen provides the best postoperative analgesia.

The pharmacokinetics of intra-articular injection of bupivacaine in the knee have been well studied.<sup>7-9</sup> These studies have shown the use of bupivacaine in knee arthroscopy to be a safe method for attempting to achieve better pain control. Many clinicians have advocated the instillation of bupivacaine at the end of knee arthroscopy for reduction of postoperative pain<sup>10-13</sup>; however, other studies have shown no benefit from this practice.<sup>14-17</sup>

Some clinicians have used intra-articular opioids to achieve postoperative pain control.<sup>18-20</sup> It has been hypothesized that the presence of opioid receptors on some cells in the inflamed knee may have a role in the reduction of pain. However, Kalso et al.<sup>5</sup> in a review of multiple randomized controlled trials found mixed results of the effect of intra-articular injections of morphine on postoperative pain and analgesic consumption.

Many investigators have used intra-articular knee injections at the end of surgery for postoperative pain control, but few have studied the effect of preoperative intra-articular knee injections.<sup>3,4</sup> The effects of each technique on postoperative pain and analgesic consumption have been mixed. These mixed results suggest the need for additional studies. Therefore, the purpose of this study was to compare the effect of preoperative versus postoperative intra-articular knee injections on postoperative pain and narcotics consumption following knee arthroscopy. We also compared the effectiveness of intra-articular epinephrine versus epinephrine plus bupivacaine, versus epinephrine plus bupivacaine plus morphine. The hypotheses were that a combination of morphine, bupivacaine, and epinephrine would be superior to bupivacaine and epinephrine and to epinephrine alone in decreasing postoperative pain and narcotics consumption, and that preoperative injections would provide improved pain control and decreased narcotics consumption for patients compared with patients receiving analgesic injections postoperatively.

## METHODS

This study was a prospective, randomized, double-blind trial. Specifically, patients, data collection personnel, and the surgeon were all blinded to the timing

of the study medication. The senior surgeon recruited patients undergoing general knee arthroscopy without concomitant ligamentous reconstruction. All patients received general anesthesia for the procedure. All patients with a history of adverse reactions to general anesthesia, or intolerance or allergy to any of the study medications were excluded. The procedures were all performed by a single surgeon (R.D.P.) and were limited to arthroscopic partial/subtotal meniscectomy, removal of loose bodies, partial synovectomy, debridement, or a combination of the above procedures. No tourniquets were used in this study. Type of operation, patient age, height, weight, gender, and length of procedure were recorded at the time of procedure.

The sample size of 50 patients provided approximately 90% power to detect differences of 2 units in total pain score. Institutional review board approval was obtained before patient recruitment and written informed consent was obtained in all cases.

The knee was injected with 60 mL of a solution 20 minutes prior to incision and 60 mL of a solution at the end of the case. All injections were performed by the senior author (R.D.P.). The senior author empirically chose 60 mL of fluid, since it was the amount he had clinically used for 10 years. The solutions were prepared by the pharmacy and the investigators were unaware of the contents. Intraoperative narcotic (fentanyl) administration was controlled based on patient weight. Patients were randomized into 6 groups:

Group 1 (n = 8). Before incision, 60 mL normal saline with 1/200,000 epinephrine. After incision, 60 mL normal saline.

Group 2 (n = 9). Before, 60 mL 0.25% bupivacaine with 1/200,000 epinephrine. After, 60 mL normal saline.

Group 3 (n = 7). Before, 60 mL 0.25% bupivacaine with 1/200,000 epinephrine and 1 mg morphine. After, 60 mL normal saline.

Group 4 (n = 8). Before, 60 mL normal saline. After, 60 mL normal saline with 1/200,000 epinephrine.

Group 5 (n = 10). Before, 60 mL normal saline. After, 60 mL 0.25% bupivacaine with 1/200,000 epinephrine.

Group 6 (n = 10). Before, 60 mL normal saline. After, 60 mL 0.25% bupivacaine with 1/200,000 epinephrine and 1 mg morphine.

Patients were transferred to the recovery room immediately after surgery. Following an appropriate stay in the recovery room, patients were discharged home the day of surgery with a prescription for an oral pain medication.

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