

PD-15. CONTINUOUS INTRA-ARTICULAR BUPIVACAINE INFUSION DOES NOT IMPROVE ANALGESIA FOLLOWING TOTAL KNEE ARTHROPLASTY

Rathmell, J.P.¹; Dayton, M.R.²; Hoeft, M.A.¹; Howe, R.²; Lee, P.¹; Incavo, S.²

1. Anesthesiology, University of Vermont College of Medicine, Burlington, Vermont; 2. Orthopaedics & Rehabilitation, University of Vermont College of Medicine, Burlington, Vermont

Recent investigations have shown improved pain control when local anesthetics are infused near the surgical site after surgery(1). This study was designed to examine the effectiveness of intra-articular bupivacaine infusion for pain control following total knee arthroplasty (TKA). After IRB approval and informed consent, fourteen patients undergoing unilateral primary TKA were enrolled in this double-blinded trial. Patients were randomly assigned to one of three groups: group 1, normal saline (n=6); group 2, 0.25% bupivacaine (n=2); group 3, 0.5% bupivacaine (n=6). After enrolling 6 patients (2/group), there were no apparent differences, and the 0.25% limb was deleted. Intraoperatively, all patients received spinal anesthesia with bupivacaine. Following wound closure, 20 mL of study solution (saline, 0.25% or 0.5% bupivacaine, according to group randomization) was placed intra-articularly and a catheter was placed in the knee joint and connected to a spring-loaded infusion device (Sgarlato Labs, Los Gatos, CA). Study solution was infused at 4 mL/hr for 24 hours. After recession of the level of sensory block below the L3 dermatome in the post-anesthesia care unit (PACU), patients received intravenous morphine until comfortable and were then placed on patient-controlled analgesia (PCA). Morphine use in PACU and for the first 24 hours after surgery was recorded. A blinded investigator recorded pain scores (0-10) and adverse effects in PACU and 24 hours after surgery. Serum bupivacaine levels were measured during the final hour of the continuous infusion (0.5% bupivacaine group only). Results were analyzed using Student's t-testing (demographic variables) and repeated-measures ANOVA (morphine consumption); $p < 0.05$ was considered significant. All data are presented as mean \pm standard error.

There were no significant differences in age, weight, height, sex, or duration of surgery between treatment groups. The highest pain scores observed in PACU (group 1-3, respectively: 7 ± 1 , 7 ± 1 , 6 ± 1 , $p = \text{NS}$) or during the first 24 hours post-operatively (group 1-3, respectively: 9 ± 1 , 9 ± 1 , 9 ± 1 , $p = \text{NS}$) were similar. Morphine requirements in PACU (group 1-3, respectively: $20 \pm 10 \text{mg}$, $14 \pm 11 \text{mg}$, $13 \pm 7 \text{mg}$, $p = \text{NS}$) and during the first 24 hours (group 1-3, respectively: $59 \pm 13 \text{mg}$, $73 \pm 11 \text{mg}$, $80 \pm 11 \text{mg}$, $p = \text{NS}$) did not differ significantly (figure 1). Serum bupivacaine levels during continuous intra-articular infusion were $0.7 \pm 0.2 \mu\text{g/mL}$ (range: $0.5 \bar{n} 1.2 \mu\text{g/mL}$).

Intra-articular bupivacaine (up to 0.5%) at a rate of 4 mL/hr following primary TKA neither reduced morphine requirements nor decreased subjective pain scores during the first 24 hours after surgery. The number of subjects in this study is too small to detect small, but statistically significant differences in pain scores or morphine requirements. However, there is no suggestion of any detectable improvement in pain control over PCA morphine alone using this method and the study has been halted following this interim data analysis. The lack of effective pain control with intra-articular bupivacaine infusion may result from the difficulty in providing effective local anesthetic effect in the relatively large intra-articular space. One patient receiving 0.5% intra-articular bupivacaine at 4 mL/hr had a serum bupivacaine level of $1.2 \mu\text{g/mL}$, in excess of the $1.0 \mu\text{g/mL}$ value at which toxicity has been reported (2). Thus, attempts to improve analgesia by using higher doses of intra-articular bupivacaine seem unwise.

(1) Savoie FH, Field LD, Jenkins RN, Mallon WJ, Phelps II, RA. The pain control infusion pump for postoperative pain control in shoulder surgery. *J Arthroscopic Surg* 16: 339-342, 2000.

(2) Hasselstrom LJ, Mogensen T. Toxic reaction of bupivacaine at low plasma concentration. *Anesthesiology* 61: 99-100, 1984.

