Journal of Clinical Anesthesia (2015) **27**, 39–44

ELSEVIER

Journal of Clinical Anesthesia

Original Contribution

The adductor canal block provides effective analgesia similar to a femoral nerve block in patients undergoing total knee arthroplasty—a retrospective study☆

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Received 7 March 2014; revised 6 August 2014; accepted 8 August 2014

Keywords:
Acute pain management;
Adductor canal block;
Femoral nerve block;
Regional anesthesia;
Total knee arthroplasty

Abstract
Study Objective: To determine the ability of an ultrasound-guided single-shot adductor canal block to provide adequate analgesia and improve performance during physical therapy.
Design: A retrospective chart review.
Setting: All procedures were performed at Ochsner Medical Center.
Measurements: Patient demographics as well as the type of peripheral nerve block performed. Pain scores and opioid consumption were recorded at postanesthesia care unit discharge and again at 8 ± 3, 16 ± 3, and 24 ± 3 hours. In addition, physical therapy performance was analyzed.
Main Results: There were no significant differences in pain scores or cumulative hydromorphone requirements between the adductor canal block group and the femoral nerve block group at any of the time points analyzed. Gait distance measured during physical therapy sessions in the adductor canal block group was superior compared with the femoral nerve block group.
Conclusion: Within the first 24 hours, a single-shot adductor canal block provides equally effective analgesia when compared with a femoral nerve block and improves postoperative physical therapy performance.

1. Introduction

Patients undergoing a total knee arthroplasty (TKA) experience significant postoperative pain [1–4]. A continuous femoral nerve block (FNB) via a femoral nerve catheter (FNC) provides excellent postoperative analgesia, decreases

☆ A portion of this data was presented during a poster session at the annual American Society of Regional Anesthesia and Pain Medicine Meeting, May 2-5, 2013, in Boston, Massachusetts.

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http://dx.doi.org/10.1016/j.jclinane.2014.08.005
0952-8180/

opioid consumption, and reduces the incidence of postoperative nausea [4–6]. Although effective in controlling postoperative pain, FNB produces quadriceps muscle weakness that impairs early postoperative mobilization and physical therapy and increases the risk of falling [2,7]. Improvements in regional analgesia after a TKA with minimal quadriceps muscle weakness may facilitate postoperative rehabilitation.

There has been recent interest in the adductor canal block (ACB) as a peripheral nerve block that may provide analgesia after knee surgery. The adductor canal is an aponeurotic structure in the middle third of the thigh, which contains several nerves involved in the innervation of the knee [8–13]. Injection of local anesthetic into the adductor canal results in sensory changes in the medial, anterior, and lateral aspects of the knee [14]. In addition, ACB also results in significantly less quadriceps weakness when compared with FNB in healthy volunteers [15]. Therefore, ACB shows potential as a primarily sensory block with limited motor involvement. Indeed, the ACB provides analgesia after arthroscopic medial meniscectomy [16] and surgical repair of the anterior cruciate ligament [17]. Furthermore, previous studies demonstrated that ACB improved reported pain scores and reduced opioid requirements when compared with placebo in patients undergoing TKA [18–21].

Evidence comparing ACB to FNB in patients undergoing TKA is still limited. Therefore, the objective of the current study was to determine the ability of an ultrasound-guided single-shot ACB to provide adequate analgesia and improve performance during physical therapy when compared with the FNB in patients undergoing TKA.

2. Materials and methods

After Ochsner Medical Center Institutional Review Board approval, a retrospective examination of the medical records of all patients who underwent a primary unilateral TKA between July 1, 2012, and October 31, 2012, was performed. Perioperative data collected included age, body mass index, gender, American Society of Anesthesiologists classification, type of regional anesthetic for postoperative pain, pain scores, cumulative opioid consumption, and gait distance during physical therapy.

All blocks were performed at Ochsner Medical Center, an academic tertiary-referral medical center, by a regional anesthesiologist or by a fellow or resident with the direct supervision of the staff regional anesthesiologist. The block performed was based on the preference of the staff anesthesiologist. For comparison, patients were divided into 2 groups. Patients in the ACB group received a preoperative ultrasound-guided single-shot ACB, as previously described [22,23], with 15 to 30 cc of 0.5% bupivacaine. At the time these procedures were performed, the standard of care for postoperative analgesia for a TKA included an FNB. Because the effectiveness of the ACB in patients having TKA was unclear, an FNC was also placed, but no local anesthetic was administered. The FNC was placed to provide supplemental analgesia in the event the ACB was not an effective analgesic block. In the situations where a femoral nerve infusion was initiated to supplement the patient's analgesia, the patient was first evaluated by a physician on the Acute Pain Service. If a patient in the ACB group experienced intolerable pain, typically >5/10 on the visual analog scale (VAS) pain scale, in the anterior or medial aspect of the knee the femoral nerve infusion was initiated. In the FNB group, an FNC was placed and bolused with 30 to 40 cc of 0.25% ropivacaine followed by a postoperative continuous postoperative infusion of 0.2% ropivacaine at 6 to 8 cc/h. The primary anesthetic for the TKA was a neuraxial block or general anesthesia at the discretion of the intraoperative anesthesiologist. In addition to the regional block, all patients received a hydromorphone patient-controlled analgesia infusion pump (0.2 mg bolus with a 6-minute lockout) postoperatively, as well as our multimodal analgesia protocol that includes celecoxib 200 mg PO daily, intravenous acetaminophen 1 g every 6 hours, and pregabalin 150 mg PO daily.

The necessity for a supplemental FNB, pain scores (VAS), and cumulative opioid consumption were recorded at the time of postanesthesia care unit (PACU) discharge and again at 8 ± 3, 16 ± 3, and 24 ± 3 hours. Patients who received a neuraxial block for the TKA were assessed after complete resolution of the neuraxial block by dermatomal regression of the sensory block and resolution of motor weakness. On the morning of postoperative day (POD) 1, physical therapy was initiated and gait distance was recorded. Gait distance was an objective assessment; only forward or backward steps were counted as distance traveled. If the patient could not ambulate or could only take side steps, the gait distance was considered to be zero.

All data points were compared between the 2 types of nerve blocks. Our primary outcome was to determine if ACB could provide analgesia equivalent to FNB at the time of discharge from the PACU. The power to detect a 30% difference in pain scores on the VAS (scored 0-10) at the time of discharge from the PACU was 26 patients in each group. A 30% difference was selected as this would certainly represent clinical significance and potentially demonstrate equivalence between the 2 regional techniques. Secondary outcomes included pain scores at 8, 16, and 24 hours; cumulative opioid consumption at PACU discharge and at 8, 16, and 24 hours; and gait distance the morning of POD 1.

Categorical variables were presented as percentages, and differences between the groups were assessed using χ^2 or Fisher exact tests. Continuous variables with nonskewed distributions were presented as mean and SD, and differences between groups were assessed using Student *t* test. Continuous variables with skewed distributions were presented as median and 25% to 75% interquartile range, and differences between groups were assessed by the