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Continuous Infusion of Bupivacaine Following Total Knee Arthroplasty: A Randomized Control Trial Pilot Study

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ABSTRACT

An RCT pilot-study was conducted to assess efficacy of a 48-h continuous local infiltration of intra-articular bupivacaine (0.5% at 2 cc/h) versus placebo (0.5% saline at 2 cc/h) in decreasing PCA morphine consumption following TKA. Secondary outcomes included 48-h VAS pain, opioid side effects, length of stay, and knee function scores up to 1-year postoperatively. Of 67 randomized patients, 49 completed the trial including 24 bupivacaine, and 25 placebo patients. Mean 48-h PCA morphine consumption did not differ significantly between treatment (39 mg ± 27.1) and placebo groups (53 mg ± 30.4) ($P = .137$). The intervention did not improve pain scores, or any other outcome studied. Given study results we would conclude that analgesia outcomes with a multimodal analgesia regimen are not significantly improved by adding 48 h of 0.5% bupivacaine infiltration at 2 cc/h.

Background

Total knee arthroplasty (TKA) is billed as a pain relieving procedure, but patients experience immense discomfort in the immediate postoperative period to attain this benefit. High postoperative pain levels decrease knee range of motion, increase narcotic analgesic use and increase hospital length of stay [1]. Being a subcutaneous structure, pain with knee movement is more intensely felt than in the hip arthroplasty population [2]. Local nociceptor control in the subcutaneous knee and intra-articular fat pad region should give better pain control, allowing earlier knee movement, less narcotic use and potentially shorter hospital stays. This goal may be potentially realised using local anesthetics.

Many orthopaedic surgeons inject local anesthetic into the joint and soft tissues after knee surgery to decrease postoperative pain, and therefore decrease the use of opioids. A single intra-articular injection of 20 ml of 0.25% bupivacaine following arthroscopic knee surgery has been shown to significantly decrease postoperative pain [3]. Badner, Bourne and Rorabeck [4] have shown that an intra-articular injection of 0.5% bupivacaine with epinephrine significantly reduced postoperative narcotic use (59 mg versus 81 mg morphine) in patients undergoing total knee arthroplasty. Further, Hoenecke, Pulido and Morris [5] found that postoperative pain was decreased (4.0 vs 2.7 on a scale of 0–10) and narcotic use was reduced by 37% after ACL reconstruction using a continuous, 48 h intra-articular infusion of bupivacaine. Knee range of motion (100° versus 70° at discharge) and hospital stay (7 days versus 9 days) have also been shown to improve with continuous infusions of ropivacaine and morphine in a non-randomized trial of primary total knee replacements [6]. Other surgical specialties have utilized the method in question. Cheong, Seow-Choen, and Eu [7] used a 48 h continuous subcutaneous infusion of bupivacaine following laparotomy. They found this method was equivalent in pain relief to patient controlled analgesia (PCA) morphine. The evidence behind single postoperative subcutaneous injections of local anesthetic is less uniform across a variety of surgical specialties [8,9].

Overall, there is a paucity of literature on continuous intra-articular bupivacaine infusion in the primary total knee arthroplasty population, with no published randomized controlled trials. As such, we chose to conduct a randomized controlled trial (RCT) pilot study to assess the efficacy of a 48-h continuous infusion of intra-articular bupivacaine versus placebo in decreasing morphine consumption and postoperative pain levels following primary TKA, with a view to conducting a large RCT based on pilot study results in future.

Method

A two-surgeon single-centre double-blind RCT pilot study was undertaken at a high volume arthroplasty centre to determine efficacy

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of a 48-h continuous infusion of intra-articular bupivacaine versus placebo in decreasing morphine consumption and postoperative pain levels following primary TKA. The primary outcome measure was morphine consumption based on cumulative PCA morphine use within the first 48 h postoperatively. Secondary outcome measures included 24 h and 48 h mean in-hospital patient visual analogue scale (VAS) pain scores rated on a scale of 0–10 from no pain to severe pain, acute hospital length of stay, and clinical outcome measures including knee range of motion, the Knee Society Score [10] and Oxford Knee Score [11] up to one year postoperatively.

Once a Health Canada Therapeutic Products Directorate no objection letter regarding the intra-articular administration/use of bupivacaine as an analgesic and formal Research Ethics Board approval were received, the recruitment process began. Eligible men or women were aged 18 to 90 years and scheduled to undergo elective primary unilateral TKA for a diagnosis of osteoarthritis. Eligible patients were cleared by anaesthesia, consented to undergo TKA with a spinal anaesthetic, and agreed to receive PCA with morphine for postoperative pain control. Patients presenting with inflammatory arthritis, significant pain of other origin, chronic pain or neuromuscular disorder, or who had known bupivacaine or morphine allergy, contra-indication to spinal anaesthesia, inability to tolerate narcotics, and/or liver or kidney dysfunction, were not considered for inclusion.

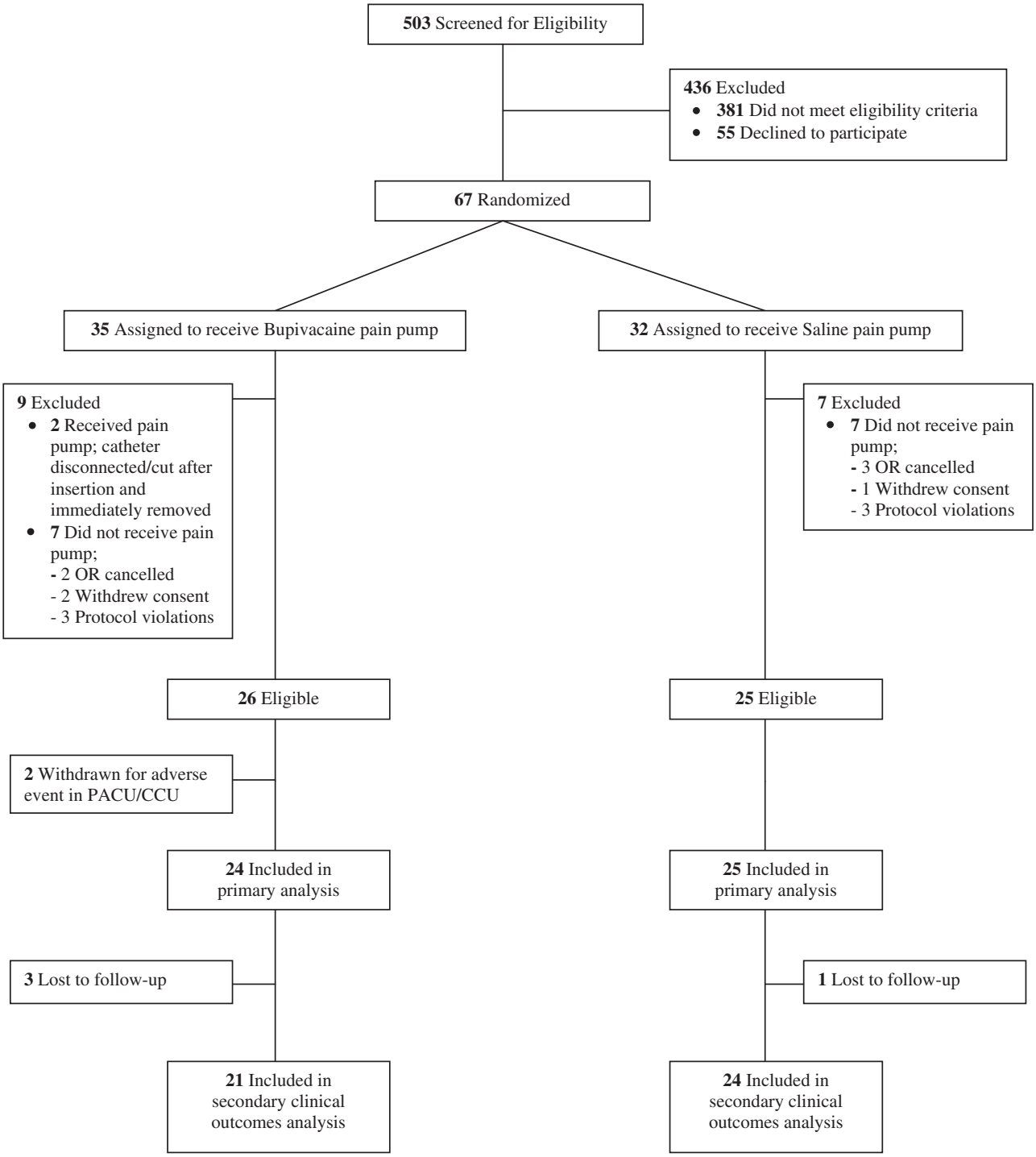

Fig. 1. Flow diagram of patient enrolment and follow-up throughout the trial.