Original Article With Video Illustration

Analgesic Effect of Hamstring Block After Anterior Cruciate Ligament Reconstruction Compared With Placebo: A Prospective Randomized Trial

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Purpose: To evaluate the effect of a hamstring block for postoperative pain management using 20 mL of 0.25% bupivacaine compared with placebo after anterior cruciate ligament (ACL) reconstruction with a hamstring autograft. **Methods:** In a 3-month period, 45 patients undergoing ACL reconstruction with a hamstring autograft who all received a femoral nerve block were randomized to receive either 20 mL of 0.25% bupivacaine or 20 mL of saline water administered through a catheter into the donor-site space. The patients and recovery staff were blinded to the treatment. Postoperative donor-site pain was evaluated subjectively by the patients using a pain score (Likert scale from 0 to 10). The pain was registered for each hour in the first 6 hours and thereafter once daily for 8 days. Furthermore, the requirement for postoperative analgesic medicine was registered. **Results:** The hamstring block group (n = 23) had significantly less pain for each of the first 6 postoperative hours. The pain score was reduced from 4.2 to 2.3 (95% confidence interval, 1.3 to 3.3) ($P = .01$) in the first hour and from 2.8 to 1.3 (95% confidence interval, 0.6 to 1.9) in the sixth hour, and there was a significantly lower overall requirement for early postoperative fentanyl, reduced from a mean of 58 to 35 μg ($P = .02$), and morphine, reduced from a mean of 10 to 6 mg ($P = .04$). After 6 hours, there was no difference in the pain level and use of analgesics between the 2 groups. **Conclusions:** With the use of a donor-site block in hamstring ACL reconstruction, the donor-site pain level, as well as the overall requirement for fentanyl and morphine, was significantly reduced in the first 6 postoperative hours. No effect of the donor-site block was seen after 6 hours. **Level of Evidence:** Level I, therapeutic, randomized controlled study.

Several graft options are available for anterior cruciate ligament (ACL) reconstruction. The use of semitendinosus and gracilis tendons has become popular for primary ACL reconstruction because the surgical technique is easy and the complication rate low.[1] Studies have shown that the amounts of overall knee pain in general and postoperative anterior knee pain in particular are lower after surgery with a hamstring autograft than after surgery with a bone—patellar tendon—bone autograft.[2,3] However, donor-site pain is also prevalent after the use of a hamstring graft.[2]

Immediate postoperative mobilization is important for the end result of an ACL reconstruction.[4] Reduction of postoperative pain should therefore be pursued to enhance optimal rehabilitation.

Knee pain after ACL reconstruction may be controlled in many ways, for instance, by use of intra-articular analgesics, a femoral nerve block, a sciatic nerve block, or a combination of these modalities.[5-10] Only a sciatic nerve block can reduce pain in the posterior part of the thigh, but this technique involves a risk of neural damage and it is a time-consuming procedure to perform.

One previous randomized study by Bushnell at al.[11] has shown that local administration of analgesics to the hamstring donor-site area effectively alleviates pain during the first 2 hours after surgery. However, this study investigated only the first 2 postoperative hours and did not register the type of analgesic and volume of

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analgesic medicine consumption. It is well known that the half-life of bupivacaine is 3.5 hours,[12] and it could therefore be expected that the effect of the local anesthesia is longer than 2 hours.

The purpose of this study was to evaluate the effect of a hamstring block for postoperative pain management using 20 mL of 0.25% bupivacaine compared with placebo after ACL reconstruction with a hamstring autograft. We hypothesized that administration of the local analgesic would significantly reduce pain and systemic analgesic consumption in the first 6 postoperative hours compared with saline solution administration.

Methods

The project was approved by the national ethical committee. All patients underwent surgery under general anesthesia supplemented with a femoral nerve block. According to the protocol, both the semitendinosus and gracilis tendons were used as grafts. A tourniquet was used set at 300 mm Hg during harvest and reconstruction. The tendons were harvested using an open tendon stripper through a 3-cm horizontal incision just medial to the tibial tuberosity. The graft was secured to the femur with an EndoButton CL (Smith & Nephew, Andover, MA) and to the tibia with a PEEK (polyether ether ketone) Biosure screw (Smith & Nephew). The femoral tunnel was drilled through an anteromedial portal. The operations were performed by 1 of the 4 senior surgeons (P.F., B.L., S.E.C., M.L.). The study complied with the Helsinki Declaration and was conducted in conformity with the recommendations for good clinical practice.

The inclusion criterion was primary isolated ACL reconstruction with a hamstring autograft. The exclusion criteria were age younger than 18 years or older than 50 years, meniscus lesions treated with repair, or severe cartilage defects of more than Outerbridge grade 2. Patients with other associated knee injuries such as collateral ligament injuries were excluded.

Anesthetic Procedure

All patients received 1 g of acetaminophen (paracetamol) and 400 mg of ibuprofen as premedication.

An ultrasound-guided technique for placement of the femoral nerve block was used. The site of injection was just under the inguinal ligament, and we injected a total of 20 mL of ropivacaine, 7.5 mg/mL, in 5-mL increments using intermittent syringe aspiration.

General anesthesia was induced intravenously with remifentanil and maintained by a continuous infusion of propofol, 50 to 100 $\mu g \cdot kg^{-1} \cdot min^{-1}$, and remifentanil, 0.3 to 0.8 $\mu g \cdot kg^{-1} \cdot min^{-1}$. Ketorolac, 30 mg intravenously, and fentanyl, 50 to 100 μg, were administered at the end of surgery. Patients stayed in the postanesthesia care unit (PACU) for a 2- to 4-hour period postoperatively, during which intravenous analgesics were administered. In the PACU the recovery staff administered fentanyl, 50 to 100 μg intravenously, and a morphine tablet, 5 mg, for the treatment of pain. They were instructed to administer fentanyl when the patient scored above 3 at rest and above 5 during activity on a numeric pain rating scale (Numeric Rating Scale [NRS]). Morphine was administered if pain was not adequately alleviated with fentanyl. All patients received prophylaxis for postoperative nausea and vomiting (PONV) with 4 mg of dexamethasone at the start of anesthesia and 4 mg of ondansetron at the end of anesthesia.

After discharge from the PACU, all patients were instructed to take acetaminophen (1 g 4 times daily) and ibuprofen (400 mg 3 times daily) as long as the pain persisted and to take morphine (5 mg) for severe pain.

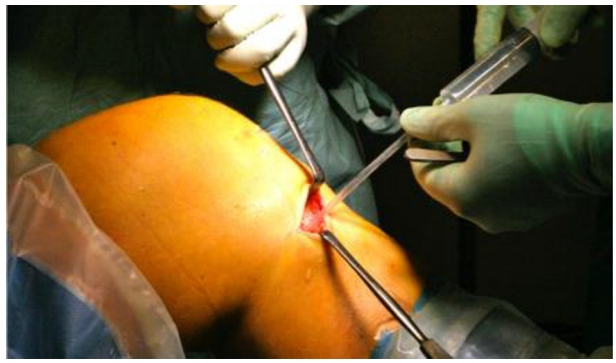

Fig 1. A sterile suction catheter stabilized with a guide pin is placed through the opened pes anserinus and guided up to the donor site to about one-third of the length of the femur. The guide pin is removed, and bupivacaine is infused as a single bolus at the end of the operation.

Study Design

The patients were randomized according to the closed-envelope method in blocks of 8. The patients received either 20 mL of 0.25% bupivacaine or 20 mL of isotonic sterile water just before the sartorius fascia was closed and skin suture was started. A sterile suction catheter stabilized with a guide pin was placed through the opened pes anserinus and guided into the donor-site space to about one-third of the femur (Fig 1). The guide pin was removed, and the study medicine was infused as a single bolus. The sartorius fascia at the pes anserinus was closed immediately after the administration of the study drug (Video 1, available at www.arthroscopyjournal.org). No drain was used, and no local anesthetic was used around the knee other than the study drug.

The randomization envelope was opened in the operating room after the introductory arthroscopy. The patients and the staff in the recovery room were blinded to the result of the randomization.