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Local infiltration analgesia or femoral nerve block for postoperative pain management in patients undergoing total hip arthroplasty. A randomized, double-blind study

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HIGHLIGHTS

- LIA results in good postoperative analgesia and lower rescue morphine requirements.
- Lower risk of motor block during 0–6 h after surgery.
- A secondary injection via the intraarticular catheter at 23 h prolongs analgesia further.

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ABSTRACT

Background and aims: Several methods for pain management following total hip arthroplasty (THA) have been described but the best postoperative pain management technique remains uncertain. We compared surgeon applied local infiltration analgesia (LIA) with anaesthesiologist performed femoral nerve block (FNB) using ultrasound. The primary aim was to assess pain intensity 24 h after THA.
Methods: In this randomized, double-blind study, 56 patients (ASA I-III) undergoing THA consented to participate. In Group FNB, patients received an ultrasound-guided femoral nerve block using 30 ml of ropivacaine 7.5 mg/ml (225 mg) while Group LIA received a similar volume of saline. Spinal anaesthesia was then performed and bupivacaine heavy, 3–3.5 ml injected depending on patient characteristics. During surgery, patients in Group LIA received a mixture of 300 mg (150 ml) ropivacaine, ketorolac 30 mg (1 ml) and adrenaline 0.5 mg (0.5 ml) (total volume 151.5 ml) peri-articularly and subcutaneously while Group FNB received 151.5 ml of saline peri-articularly in a systematic way by the surgeon. A multi-hole catheter was placed with the tip placed intra-articularly at the end of surgery in both groups. After 23 h, the LIA mixture consisting of 20 ml ropivacaine (7.5 mg/ml), ketorolac 30 mg (1 ml), adrenaline 0.1 mg (1 ml) (total volume 22 ml) was injected in Group LIA and the same volume of saline in Group FNB. Postoperative pain, analgesic consumption (postoperative and post-discharge), side effects, home discharge, quality of life and hip function were recorded, the latter up to 6 months after surgery.
Results: Postoperative pain intensity was significantly lower in Group LIA compared to Group FNB during mobilization at 24 h (primary endpoint), mean difference 1.8 NRS units (95% CI 0.7–2.9) ($P = 0.006$), at rest after 4 h ($P = 0.029$) and on standing after 24 ($P = 0.0003$) and 48 h ($P = 0.043$). Rescue morphine consumption was also significantly lower in Group LIA during 0–24, mean difference 13.5 mg (95% CI, 6.1–20.9) ($P = 0.002$) postoperatively. Motor block was greater at 6 h ($P = 0.029$) postoperatively in Group FNB. Two patients (one in each group) had persistent post-surgical pain (NRS > 3) at 3 months (3.6%) but none at 6 month. No other differences were found between the groups.

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Conclusion: Local infiltration analgesia significantly reduces pain intensity on standing and mobilization, and rescue analgesic consumption compared to femoral nerve block without causing significant side effects. The superior analgesia in the LIA group may result from the secondary injection at 23 h postoperatively and needs to be further evaluated in future studies. No differences were found in home discharge, quality of life and hip dysfunction between the groups.
Implication: Local infiltration analgesia is the preferred method for postoperative pain management following THA compared to single-shot femoral nerve block.

1. Introduction

Total hip arthroplasty (THA) is a common procedure often performed under spinal anaesthesia in Sweden. Postoperative pain is moderate and pain relief can be achieved using spinal morphine, local infiltration analgesia (LIA) [1], patient controlled analgesia or peripheral nerve blocks (PNB). The PROSPECT group recommends a multimodal pain management strategy using oral and intravenous drugs following THA [2]. Recently, and with the easy availability of ultrasound technique, PNBs have become popular for postoperative pain management. In a comprehensive review of the literature and meta-analysis, however, no difference was found between LIA and PNB [3]. In this meta-analysis, PNBs included femoral nerve block or 3-in-1 block, lumbar plexus block, psoas compartment block, and fascia iliaca compartment block. We have previously shown better patient-related outcomes following LIA compared to intrathecal morphine in patients undergoing THA [4].

The nerve supply to the hip joint is complex but it is primarily innervated by the femoral, obturator and lateral femoral cutaneous nerves anteriorly and the sciatic nerve posteriorly. Multiple blocks encompassing the whole hip joint to achieve complete pain relief can be time-consuming and a challenge, even when using ultrasound techniques. The ideal PNB for THA is probably the lumbar plexus block but this requires long operator experience, takes time to perform and has a greater risk for complications [5]. The femoral nerve block (FNB) has recently been shown to be as effective as lumbar plexus block for THA [6]. Alternatively, the FNB may be used together with distal pressure on the nerve and a larger volume of local anaesthetic (also called 3-in-1 block), resulting in better lateral and medial spread of local anaesthetic, and improved outcomes [7]. The FNB has been shown to be efficacious for THA in several studies [8,9].

Our hypothesis was that local infiltration analgesia is superior to ultrasound-guided FNB for postoperative pain management following THA. The primary aim of this study was to determine pain intensity on mobilization at 24 h after total hip arthroplasty. Secondary aims were: cumulative morphine consumption at 24 h, incidence of persistent post-surgical pain, time to home discharge, side effects and complications, analgesic consumption at home during two weeks postoperatively, and health-related quality of life and hip disability at three and six months after home discharge using standardized questionnaires.

2. Patients and methods

The Regional Ethics committee in Uppsala and the Swedish Medical Products Agency approved the study prior to patient recruitment. It was registered in an International database (EudraCT number 2012-003875-20) and the study was conducted according to Good Clinical Practice. All patients gave verbal and written informed consent prior to enrolment. The study was prospective, randomized, double-blind, parallel group and conducted at the University Hospital, Örebro during the period 25th September 2013 to 1st December 2015 (last patient follow-up). No changes were made to study protocol after study start. Inclusion criteria were: ASA I-III patients, 18–80 years age who had no difficulty in understanding the Swedish language or following the protocol. Exclusion criteria were: patients taking opiates preoperatively for pain management, allergy to local anaesthetics or known contraindications to non-steroidal anti-inflammatory drugs (NSAIDs), re-operation THA, serious liver, heart or kidney diseases, known bleeding disorders, contraindications to spinal anaesthesia and participation in another clinical trial. All patients stopped taking NSAIDs or acetylsalicylic acid prior to surgery. Patients were given instructions about the numeric rating score (NRS) 0–10 (0 = no pain, 10 = worst imaginable pain) as well as on the use of the patient-controlled analgesia (PCA) morphine device prior to anaesthesia.

2.1. Preoperative preparation

All surgeons saw a pre-recorded film demonstrating the volume and site where the drugs/saline were to be injected during LIA. Health-related quality of life was measured using the EQ5D (European Quality of life, 5 Dimensions) and the degree of preoperative disability using the HOOS (Hip and Osteoarthritis Outcome Score) (described below). All patients received midazolam 0.03 mg/kg orally as premedication, paracetamol 1 g 1 h before planned surgery, and cloxacillin 1 g as prophylactic antibiotic just before incision.

2.2. Randomization and blinding

Randomization was performed with concealed allocation using computer generated random numbers inserted into opaque, sealed envelopes. A total of 60 envelopes (30/group) numbered 1–60 were thus created. Personnel not involved in the study performed the blinding. The randomization list was kept in a locked cupboard, not accessible to the researchers or personnel involved in the study. Full blinding was thus maintained until the study was terminated.

2.3. Anaesthesia and analgesia

An ultrasound-guided probe was used in order to identify the femoral nerve, and correct needle placement was confirmed by using a nerve stimulator and observing the “patellar dance”. Thereafter, and according to group randomization, one of the following solution was injected while applying distal pressure at the injection site.

Group LIA (Local Infiltration Analgesia): 30 ml of 0.9% saline;
Group FNB (Femoral nerve block): 30 ml of ropivacaine 7.5 mg/ml.

Spinal anaesthesia with bupivacaine plain 3–3.5 ml, depending on patient characteristics, was used as the anaesthetic. During surgery, a total of 151.5 ml of the study drug was injected in a standardized and systematic way (described below) by the surgeon according to group randomization.

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