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Analgesic efficacy of local infiltration analgesia in hip and knee arthroplasty: a systematic review

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Editor's key points

- Growing interest in local infiltration pain relief has led to novel management of patients in hip and knee arthroplasty.
- The authors examined the evidence base for this practice, finding better support for its use in knee surgery than in hip surgery.
- Wound infusion catheters were not shown to provide additional benefit, and length of hospital stay appeared unaffected by local infiltration protocols.

In recent years, there has been an increasing interest in local infiltration analgesia (LIA) as a technique to control postoperative pain. We conducted a systematic review of randomized clinical trials investigating LIA for total knee arthroplasty (TKA) and total hip arthroplasty (THA) to evaluate the analgesic efficacy of LIA for early postoperative pain treatment. In addition, the analgesic efficacy of wound catheters and implications for length of hospital stay (LOS) were evaluated. Twenty-seven randomized controlled trials in 756 patients operated on with THA and 888 patients operated on with TKA were selected for inclusion in the review. In THA, no additional analgesic effect of LIA compared with placebo was reported in trials with low risk of bias when a multimodal analgesic regimen was administered perioperatively. Compared with intrathecal morphine and epidural analgesia, LIA was reported to have similar or improved analgesic efficacy. In TKA, most trials reported reduced pain and reduced opioid requirements with LIA compared with a control group treated with placebo/no injection. Compared with femoral nerve block, epidural or intrathecal morphine LIA provided similar or improved analgesia in the early postoperative period but most trials had a high risk of bias due to different systemic analgesia between groups. Overall, the use of wound catheters for postoperative administration of local anaesthetic was not supported in the included trials, and LOS was not related to analgesic efficacy. Despite the many studies of LIA, final interpretation is hindered by methodological insufficiencies in most studies, especially because of differences in use of systemic analgesia between groups. However, LIA provides effective analgesia in the initial postoperative period after TKA in most randomized clinical trials even when combined with multimodal systemic analgesia. In contrast, LIA may have limited additional analgesic efficacy in THA when combined with a multimodal analgesic regimen. Postoperative administration of local anaesthetic in wound catheters did not provide additional analgesia when systemic analgesia was similar and LOS was not related to use of LIA with a fast-track set-up.

Keywords: anaesthesia, local; arthroplasty; pain, postoperative

Local infiltration analgesia (LIA) with intra-operative administration of local anaesthetic in various combinations with epinephrine, non-steroidal anti-inflammatory drugs, opioids, steroids, or all to the wound is a simple, surgeon-administered technique for the treatment of postoperative pain after hip (THA) and knee (TKA) arthroplasty.[1–7] The technique may be supplemented by placement of a wound catheter intended to prolong analgesia by infusion of local anaesthetic (and other analgesics) to the wound in the postoperative period.[5 8 9]

The LIA technique was originally presented by Bianconi and colleagues,[10] Kerr and Kohan[11], and others, with promising preliminary results especially from a non-randomized observational study in 325 patients demonstrating excellent pain control and discharge from hospital the day after surgery in 71% of patients.[11] The technique has gained widespread use[12–14] although the optimal design of the LIA technique (i.e. infiltration technique, drug mixture, use of wound catheters, etc.) has not been completely evaluated.[5]

However, the specific evidence of analgesic efficacy of LIA after THA and TKA has been confounded by frequent limitations in study design because of the lack of comparable systemic analgesia between groups. Furthermore, wide variations in the LIA technique/drug combinations have been used in the clinical trials.

We, therefore, critically evaluated the analgesic efficacy of intra-operative LIA in THA and TKA in a systematic search and review of the available randomized clinical trials in the early (<72 h) postoperative period along with an assessment

of the risk of bias in each individual trial. Secondary outcomes were assessment of the analgesic efficacy of wound catheters determined by postoperative opioid consumption and implications for length of hospital stay (LOS).

Methods

Search strategy and criteria

Protocol and registration: the review protocol was not registered prior to data collection and writing of the manuscript.
Types of studies: prospective randomized clinical trials investigating analgesic efficacy of intra-operative peri-articular injection of local anaesthetic for THA and TKA.
Types of participants: participants of any age operated on with TKA or THA.
Types of intervention: trials comparing the analgesic efficacy of intra-operative local anaesthetic infiltration with placebo (saline or no injection), peripheral nerve block techniques (PNB), continuous epidural analgesia, or intrathecal morphine. In addition, clinical trials evaluating the analgesic effect of postoperative local anaesthesia administration through wound/intra-articular catheters.
Types of outcome measures: primary outcome measure was postoperative pain recorded on a visual analogue scale or numeric rating scale. Secondary outcome measure was postoperative opioid consumption and LOS.
Information sources: literature search was performed using the National Institute of Health PubMed database, Google Scholar, and the Cochrane Library without language, age, or gender restrictions.
Search: search was performed using the terms 'local infiltration analgesia', 'LIA', 'hip arthroplasty', 'THA', 'knee arthroplasty', and/or 'TKA'. The reference list of each identified trial was reviewed to ensure inclusion of all randomized controlled trials investigating LIA for THA or TKA. Trials published until June 1, 2013 were included. Selected recent publications thereafter were only included in the discussion.
Study selection: the authors independently performed assessment of study eligibility in an unblinded manner and disagreement was resolved by consensus.
Data collection process: data were independently extracted by the authors from each included trial.
Data items: information on (a) study characteristics, participants, and design, (b) type of intervention (including specific LIA technique applied), (c) type of systemic analgesia, (d) pain and opioid requirements in the early (<72 h) period, and (e) analgesic efficacy of supplemental wound catheter administration of local anaesthetic in the postoperative period along with (f) LOS was extracted from each included trial and summarized
Risk of bias in individual studies: a summary assessment of risk of bias in individual studies was performed in accordance with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement.
Summary measures: study outcomes were summarized with qualitative interpretation of individual studies methods and results.

Results

A total of 27 studies were identified for inclusion in the review. The search of PubMed, Google Scholar, and the Cochrane library with combined search terms produced 43 citations of which 14 were excluded because they did not meet the inclusion criteria as described on the basis of title and abstract. An additional two studies[8 9] were excluded from the review after detailed assessment because these trials did not meet the inclusion criteria as described. No additional studies were identified after checking the reference lists of identified trials and unpublished studies were not searched for (Fig. 1).

All 27 studies selected for the review were randomized controlled trials and involved 888 patients operated on with TKA and 756 patients operated on with THA. The study characteristics are outlined in Table 1 (THA) and Table 2 (TKA).

Primary study outcome measures included pain at rest and with mobilization measured on a visual analogue scale, cumulated opioid consumption in the postoperative period and time to discharge readiness, actual LOS, or functional outcome measures such as range of knee motion. A summary of study outcome measures is presented in Table 1 (THA) and Table 2 (TKA).

Risk of study bias of included trials is summarized in Table 3 (THA) and Table 4 (TKA). In THA only 2 trials (including 132 patients) were considered with a low risk of bias (Table 3). The remaining 8 trials investigating the analgesic efficacy of LIA for THA were all confounded by incomplete blinding or because systemic analgesia (NSAID) was different in control and intervention groups thereby preventing interpretation of LIA *per se*. In TKA only 2 trials (including 28 patients/56 knees operated on with simultaneous bilateral knee arthroplasty) could be considered with low risk of bias (Table 4). The remaining 15 trials in TKA were inadequately blinded or did not include similar systemic analgesia in intervention and control groups and therefore prevented interpretation of the LIA *per se*.

Studies comparing LIA with saline injections or no injections

In this subgroup, 7 randomized trials in THA[15–21] including 496 patients compared LIA with saline or no injections (Table 1). Only two of these trials had low risk of bias (Table 3) with identical systemic analgesia in both groups,[17 18] and in these trials postoperative pain sores were very low and no statistically significant differences in pain scores or opioid requirements were observed in the early postoperative period (0–24 h postoperatively) when LIA was combined with a multimodal systemic analgesic regimen with acetaminophen, celecoxib, and gabapentin (Table 1).

In TKA 7 randomized trials[25–31] including 328 patients investigated the analgesic efficacy of LIA compared with saline or no injection (Table 2). Six of these trials[25–28 30 31] reported reduced pain scores and reduced opioid consumption in the early postoperative period (0–32 h postoperatively) and 1 trial comparing LIA with placebo in combination with a femoral nerve block (FNB) in both groups reported similar