American Pain Society
RESEARCH
EDUCATION
TREATMENT
ADVOCACY
PUBLISHED BY ELSEVIER

The Journal of Pain, Vol 15, No 8 (August), 2014: pp 781-799
Available online at www.jpain.org and www.sciencedirect.com

Critical Reviews

Local Infiltration Analgesia for Postoperative Pain After Hip Arthroplasty: A Systematic Review and Meta-Analysis

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Abstract: **Postoperative pain after hip arthroplasty (HA) is very common and severe. Currently, use of routine analgesic methods is often accompanied by adverse events (AEs). Local infiltration analgesia (LIA) for controlling pain has been a therapeutic option in many surgical procedures. However, its analgesic efficacy in HA and its safety remain unclear. Data from 9 randomized controlled trials, involving 760 participants, comparing the effect of LIA with that of placebo infiltration or no infiltration on patients undergoing HA were retrieved from an electronic database, and the pain scores, analgesic consumption, and AEs were analyzed. Effects were summarized using weighted mean differences, standardized mean differences, or odds ratio with fixed or random effect models. There was strong evidence of an association between LIA and reduced pain scores at 4 hours at rest ($P < .00001$) and with motion ($P < .00001$), 6 hours with motion ($P = .02$), and 24 hours at rest ($P = .01$), and decreased analgesic consumption during 0 to 24 hours ($P = .001$) after HA. These analgesic efficacies for LIA were not accompanied by any increased risk for AEs. However, the current meta-analysis did not reveal any associations between LIA and the reduced pain scores or analgesic consumption at other time points. The results suggest that LIA can be used for controlling pain after HA because of its efficacy in reducing pain scores and thus can reduce analgesic consumption on the first day without increased risk of AEs.**

Perspective: ***This is the first pooled database meta-analysis to assess the analgesic effects and safety of LIA in controlling pain after HA. The derived information offers direct evidence that LIA can be used for patients undergoing HA because of its ability to reduce pain scores and analgesic consumption without any additional AEs.***

Key words: *Local infiltration analgesia, hip arthroplasty, postoperative pain, review, meta-analysis.*

Orthopedic surgery is one of the most painful surgical procedures, with 41% of patients reporting moderate to severe postoperative pain.[51] With the aging of society, hip arthroplasty (HA) has become a common orthopedic surgery. Surgical damage following HA involves a large, deep incision with considerable tissue dissection as well as exposure of muscle, bone, and vessels, which may lead to unbearable postoperative pain. The pain intensity at rest usually decreases significantly.[58] However, pain can be exacerbated by spasm of the femoral quadriceps during body movement, which may delay motor function recovery, reduce satisfaction, prolong hospitalization, and ultimately increase medical costs.[9,12] Thus,

J.-B.Y., G.-B.C., and M.-S.M. contributed equally to this work.

Partly supported by the Innovation International Science & Technology Cooperation Program of China (2011DFA32560, to S.-X.W.), Program for Shaanxi Province Key Research Team of Science and Technology Innovation (2012KCT-14, to S.-X.W.), the Natural Key Plan of Shaanxi province (2008K13-04, to G.-B.C.), intramural grant of the Fourth Military Medical University (to W.W.).
There are no conflicts of interests including finance, honoraria, travel to conferences, consultancies, stock ownership, and equity interests.
Supplementary data accompanying this article are available online at www.jpain.org and www.sciencedirect.com.

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1526-5900/$36.00

http://dx.doi.org/10.1016/j.jpain.2014.03.002

comprehensive analgesic regimens that provide excellent pain relief both at rest and on movement with minimal adverse events (AEs) and without impairment in motor function are desirable.

Established postoperative analgesic methods for HA include epidural analgesia, spinal analgesia, intravenous patient-controlled opioid analgesia, and peripheral nerve blocks.[18] Epidural analgesia is limited to 4 to 6 hours after HA and leads to many AEs, such as hypotension, pruritus, and urinary retention, and delays the initiation of anticoagulant thromboprophylaxis.[13] Spinal analgesia is commonly used in the clinical setting of HA but also tend to be associated with many AEs, including headache, neurogenic bladder, hypotension, respiratory depression, pulmonary hypertension, cardiac complications, and risk for spinal infection.[39,50] Although one meta-analysis has shown these postoperative methods to have several potential advantages over general anesthesia,[27] and there have been many refinements to reduce such complications, there is still the potential for inadvertent dural puncture and neurologic injury, which may make these techniques less acceptable.[42] On the other hand, peripheral nerve block including lumbar plexus or femoral and sciatic nerve blocks has become more popular in HA but is associated with technical difficulties[22,30] as well as the possibility of affecting quadriceps strength and increasing the risk of falling.[29]

The challenges for new analgesic strategies include avoidance of AEs while maintaining adequate pain relief. A convenient analgesic protocol is to inject local anesthetics during surgery or to place a multihole catheter in the surgical site at the end of surgery for reinjection or continuous infusion of local anesthetics after operation. Administering local anesthetics into the surgical area recently has been proved effective in reducing postoperative pain after various surgical procedures, including orthopedic, general, and gynecologic.[10,19,21,25,47,49]

Local infiltration analgesia (LIA) involves the infiltration of a large volume of a certain diluted long-acting local anesthetic, with or without adjuvants (eg, epinephrine, ketorolac, and opioids), into the operation site. The duration of analgesia can also be prolonged by the placement of a catheter into the surgical site for postoperative administration of further local anesthetics.[40] LIA has gained popularity since it was first applied in HA by Kerr and Kohan,[33] who concluded that LIA was simple, practical, safe, and effective for pain management after HA. A recent systematic review suggested that the LIA technique was an effective analgesic method[40]; however, the evidence level was low, for it included only 7 studies (only 3 randomized controlled trials [RCTs] comparing with placebo saline infiltration), 1 single-blind trial, and 2 case series, and no meta-analysis was performed. In addition, several RCTs appeared recently reporting contradictory results. Dobie et al[16] concluded that periarticular LIA during HA did not reduce pain or length of hospital stay or improve early postoperative mobilization; Solovyova et al[55] reported that LIA provided no additional analgesic benefit or reduction in opioid consumption compared with placebo following HA. Thus, it is necessary to perform a systematic review and meta-analysis to summarize the current available RCTs in order to draw a relatively confirmative conclusion.

Methods

Based on the QUORUM guidelines (Quality of Reporting of Meta-analysis)[41] and the recommendations of the Cochrane Collaboration,[7] we performed the current meta-analysis.

Search Strategy and Eligibility Criteria

The electronic databases screened were MEDLINE (1972 to November 2013), Scopus (1972 to November 2013), Embase (1990 to November 2013), and The Cochrane Library (Issue 11 of 12, November 2013), including the Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, and Health Technology Assessments. Searches were limited to studies with human subjects and performed for all languages, years, and types of publication. The keywords included *local infiltration anesthesia*, *local infiltration analgesia*, *regional infiltration anesthesia*, *regional infiltration analgesia*, *local blockade anesthesia*, *local blockade analgesia*, *regional blockade anesthesia*, *regional blockade analgesia*, *joint infiltration analgesia*, *joint infusion analgesia*, *periarticular infiltration analgesia*, *wound infiltration analgesia*, *wound infusion analgesia*, *intraarticular analgesia*, or *periarticular analgesia*, which were used in combination with *HA* or *hip replacement*. Two authors (J.-B.Y. and M.-S.M.) independently screened the titles and abstracts to identify potentially relevant studies. Then the full texts of eligible studies were examined independently to determine whether they met the inclusion criteria. The references of retrieved publications were also manually checked to add studies potentially meeting the inclusion criteria that might have been missed by the electronic search. The full search strategy shown in Fig 1 was developed for MEDLINE and also adapted for other electronic databases.

We sought to identify all RCTs that examined the analgesic effects and AEs of LIA (LIA group) compared with placebo infiltration or no infiltration (control group) in patients undergoing HA. Currently there is no uniform and optimal way of performing LIA, so RCTs were included regardless of their use of intraoperative LIA or intraoperative and postoperative LIA, the use of ropivacaine or other local anesthetic with or without adjuvants, the types of adjuvants the anesthetics contained, and the types of surgery. Also, we did not make distinctions in the concentration or volume of drugs that were used. Trials in which LIA was compared with other analgesic methods (eg, epidural infusion or intrathecal injection), single-blind RCTs, and self-controlled RCTs were excluded.

Data Extraction

All data (study characteristics and outcomes) were independently extracted from the included studies. All