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Original research

Local anesthetic infusion pump for pain management following open inguinal hernia repair: A meta-analysis

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ABSTRACT

Objectives: Open inguinal hernia repair is one of the most painful procedures in day surgery. A continuous ambulatory analgesic is thought to reduce postoperative pain when it is applied to the surgical site. The aim of this study is to evaluate the efficacy of local anesthetic infusion pump following open inguinal hernia repair for the reduction of postoperative pain.

Methods: We conducted a systematic review and meta-analysis of randomized controlled trials (RCTs) that have investigated the outcomes of using an infusion pump for delivering a local anesthetic contrasted to a control group for open inguinal hernia repair. Pain was assessed from Day 1 to Day 5 following the surgery. The secondary outcomes included analgesia use and postoperative complications.

Results: We reviewed 5 trials that totaled 288 patients. The analgesic effects of bupivacaine (4 trials) and ropivacaine (one trial) were compared with a placebo group. The pooled mean difference in the score measuring the degree of pain diminished significantly at Day 1 to Day 4 in the experimental group. Two studies have reported that the number of analgesics required also decreased in the experimental group. No bupivacaine-related complication was reported.

Conclusion: Our results revealed that applying a local anesthetic infusion pump following inguinal hernia repairs was more efficacious for reducing postoperative pain than a placebo. However, the findings were based on a small body of evidence in which methodological quality was not high. The potential benefits of applying a local anesthetic infusion pump to hernia repair must still be adequately investigated using further RCTs.

1. Introduction

Acute postoperative groin pain is a frequent complication that occurs after an open inguinal hernia. After a day-case inguinal hernia repair, 10% of patients experience severe postoperative pain requiring a general practitioner to administer intramuscular opiates [1]. In addition, the pain following an inguinal hernia repair is more intense when patients mobilize or cough postoperatively; consequently, patients tend to prefer the comfort of their hospital bed, thus increasing the hospital stay [2,3].

Multiple modalities have been used to treat groin pain complications; these methods include administering oral opiates and intramuscular or intravenous analgesia agents, and implementing pre-emptive and postoperative blockades by using locoregional anesthesia, ilioinguinal nerve blockades, ilioinguinal neurectomies, and caudal blockades [4–6]. Systemic analgesics such as opioids might cause nausea, vomiting, itching, respiratory problems, sedation, and increase the duration of postoperative ileus, [7,8] whereas non-steroidal anti-inflammatory drugs might cause gastrointestinal upset. These side effects can be reduced by lowering the amount of opioid drugs that are administered.

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Reducing postoperative pain and the daily administration of narcotics to patients following inguinal repairs is, therefore, critical to achieving more rapid recovery and shorter hospitalization.

An alternative approach to pain relief is to continuously infiltrate a wound via an indwelling irrigation apparatus by using a local anesthetic solution. Because this method uses a fine catheter inserted into the wound before surgical closure, it can reduce postoperative opiate requirements [9]. Several randomized controlled trials (RCTs) have investigated the efficacy of applying a local anesthetic infusion pump in patients undergoing open inguinal hernia repair; however, the results have been inconclusive [10,11]. Therefore, we conducted a systematic review and meta-analysis of the evidence that is available to date on the outcomes of the use of an infusion pump for delivering local anesthetics to open inguinal hernia repair.

2. Materials and methods

2.1. Inclusion criteria

Our analysis included only previous RCTs that evaluated the outcome of applying a local anesthetic infusion pump in open inguinal hernia repair. The studies were required to clearly define the criteria used to include and exclude the patients for the study, to report the anesthetic and the surgical hernia repair techniques, and to define and evaluate the postoperative pain and the use of the appropriate study controls. Previous RCTs were excluded from our meta-analysis based on the following criteria: (1) they included patients who underwent other surgical procedures concomitantly, such as laparoscopic hernioplasty; (2) they included appropriate data that could not be extracted or calculated from the published results; or (3) they duplicated the reporting of patient cohorts.

2.2. Search strategy and study selection

Studies were identified using computerized searches of the PubMed, EMBASE, SCOPUS, and Cochrane central registers of controlled trial databases, as well as the ClinicalTrials.gov registry (http://clinicaltrials.gov/). The following terms were used for MeSH and free-text searching: *inguinal hernia*, *hernia repair*, *hernioplasty*, *herniorrhaphy*, *local anesthesia*, *local anesthetic*, *continuous infusion*, *pump*, and *pain control*. The "related articles" function in PubMed was used to broaden each search; we reviewed all the abstracts, the study reports, and the related citations that were retrieved. No language restrictions were applied. The last search was performed in November 2013. We also identified additional studies by reviewing the reference sections of the relevant publications and by consulting with experts in the field of abdominal surgery.

2.3. Data extraction

Baseline and outcome data were independently extracted by 2 reviewers. The study design, the participant characteristics, the inclusion and exclusion criteria, the matching criteria, the anesthetic techniques used, the complications, and the operative and postoperative parameters were extracted. The inconsistencies between the findings of the 2 reviewers were resolved by a third reviewer.

2.4. Methodological quality appraisal

We assessed the methodological quality of each study based on the adequacy of the randomization, the allocation concealment, the blinding of the patients and the outcome assessors, the reporting of the study withdrawals, the performance of an intention-to-treat analysis, and other possible biases.

2.5. Outcomes and statistical analysis

The primary outcome was the severity of postoperative pain from Day 1 to Day 5. The secondary outcomes included complications and analgesia consumption.

All the data were entered and analyzed using Review Manager, version 5 (Cochrane Collaboration, Oxford, England). A meta-analysis was performed following the PRISMA guidelines [12]. When necessary, standard deviations were estimated using the confidence interval limits, the standard error, or the range values provided in previous studies. The effect sizes of the dichotomous outcomes were reported as risks ratios (RR), and the mean difference was reported for continuous outcomes. The precision of the effect sizes was based on a 95% confidence interval (CI). A pooled estimate of the RR and the mean difference was computed using the DerSimonian and Laird random-effect model [13]. This model appropriately estimates the average treatment effect when trials are statistically heterogeneous, and it usually yields relatively wide CIs, thereby producing more conservative statistical claims.

To evaluate the statistical heterogeneity and the inconsistency of the treatment effects across the studies, Cochrane's Q test and I^2 statistics were respectively used. The statistical significance was set at 0.10 for Cochrane's Q test. The proportion of the total outcome variability that was attributable to the variability across the studies was quantified as I^2.

3. Results

3.1. Characteristics of the trials

The flowchart in Fig. 1 shows the process that was used to screen and select the RCTs. Our initial search yielded 451 citations. Based on the mentioned screening criteria, 277 titles and abstracts were excluded. We reviewed the full text of the remaining 174 reports; 168 studies were excluded for the following reasons: one trial was

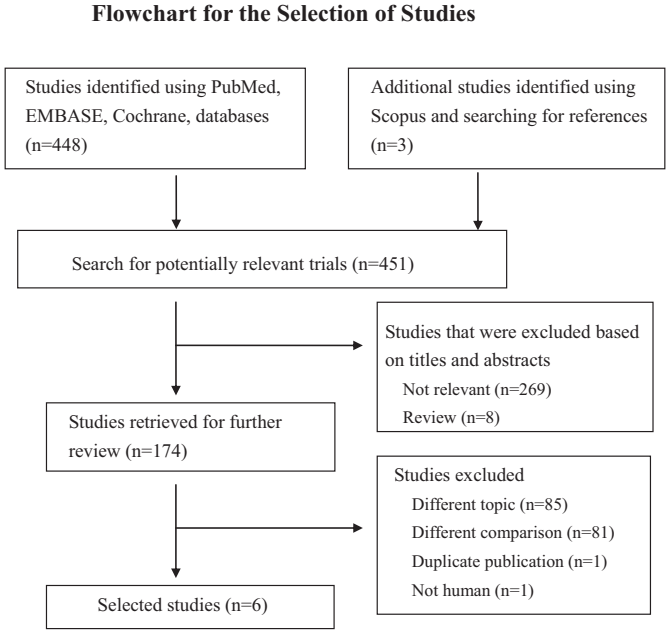

Fig. 1. Flowchart describing the selection of the randomized controlled trials for our meta-analysis.