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Original article

Local infiltration analgesia versus femoral nerve block in total knee arthroplasty: A meta-analysis

X.-D. Yun [1], X.-L. Yin [1], J. Jiang [1], Y.-J. Teng, H.-T. Dong, L.-P. An, Y.-Y. Xia *

Department of Orthopaedics, Orthopaedics Key Laboratory of Gansu Province, Second Hospital of Lanzhou University, No. 82 Cuiyingmen, Chengguan District, Lanzhou, Gansu, PR China

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ABSTRACT

Introduction: Local infiltration analgesia (LIA) and femoral nerve block (FNB) are both used for the pain management after total knee arthroplasty (TKA). Controversy still remains regarding the optimal technique for pain relief in patients undergoing TKA. The purpose of this meta-analysis was to compare the analgesia achieved with LIA and the one from FNB following TKA.
Hypothesis: LIA achieves better pain control than FNB in patients with TKA.
Methods: Databases, including Pubmed, EMBASE, the Cochrane Library and Web of Science were comprehensively searched to identify studies comparing LIA with FNB for patients with TKA. Two reviewers independently selected trials, extracted data, and assessed the methodological qualities of included studies. Data were analyzed by RevMan 5.2.
Results: Nine RCTs involving 782 patients were included. LIA achieved more rapid pain relief (VAS) at 6 h postoperatively [$SMD_{6h} = -0.92$, 95% CI (−1.38, −0.47)] than FNB. There were no significant differences at 24 h and 48 h [$SMD_{24h} = -0.03$, 95% CI (−0.46, 0.40); $SMD_{48h} = 0.28$, 95% CI (−0.35, 0.91)], VAS with activity at 24 h and 48 h [$SMD_{6h} = -0.54$, 95% CI (−1.62, 0.54); $SMD_{24h} = -0.22$, 95% CI (−1.41, 0.96); $SMD_{48h} = -0.08$, 95% CI (−0.52, 0.69)], opioid consumption at 24 h and 48 h [$SMD_{24h} = -0.24$, 95% CI (−0.82, 0.34); $SMD_{48h} = 0.15$, 95% CI (0.25, 0.54)] and length of hospital stay [MD = −0.52, 95% CI (−1.13, 0.09)].
Discussion: LIA may be the better choice in the pain management of TKA for it could achieve fast pain relief and is easier to perform than FNB for patients with TKA.
Level of evidence: Level II, meta-analysis and systematic review.

1. Introduction

Total knee arthroplasty (TKA) is one of the most common surgical treatments for advanced osteoarthritis of the knee joint. Patients undergoing TKA often experience moderate to severe postoperative pain, leading to immobility-related complications, delay in hospital discharge, and interfere with functional outcome [1]. Effective pain control allows for earlier ambulation and initiation of physiotherapy, which hastens recovery, reduces the length of stay in the hospital, and lowers the risk of postoperative complications [2]. Patient-controlled analgesia (PCA), epidural analgesia (EA) and regional anesthesia are commonly used as analgesic options for TKA [3]. PCA opioids are often used as the primary analgesic for TKA and are frequently associated with side effects, such as nausea, vomiting, pruritus, and sedation [4]. EA has been popular over recent decades, but patients who received epidurals had more frequent hypotension, urinary retention, and pruritis whereas systemic opioids caused more sedation [5].

Regional anesthesia, such as femoral nerve blocks (FNB) has been used for it reduced the postoperatively need for opioids after TKA [4]. FNB has been part of the standard postoperative pain relief protocols following TKA over recent years, which has many advantages over PCA or EA in TKA [6,7]. However, Fowler et al. [7] revealed that FNB had an improved side effect profile than EA. In addition, Sharma et al. [8] found that femoral neuropathy, neuritis and postoperative falls are complications of FNB after TKA, which can lead to injury requiring reoperation. Besides, vascular puncture and nerve damage were often reported after FNB [3,4,6].

Local infiltration analgesia (LIA) is an alternative regional anaesthesia technique with intraarticular or periarticular drugs injected into the knee joint at the end of the operation, which is simple and avoids potential complications associated with nerve blocks [9]. Several randomized studies have been performed to evaluate the

* Corresponding author. Tel.: +86 93 189 424 60.
E-mail address: xiayylzu@126.com (Y.-Y. Xia).
[1] All first three authors contributed equally to this work.

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efficacy of LIA compared with FNB. Some authors demonstrated excellent postoperative pain control after TKA using LIA [10–13]. Opposite conclusions have been reached by other authors who have shown that FNB provides a better analgesia compared with LIA [14,15]. There is still controversy over which of the two techniques leads to better pain relief after TKA.

To investigate which technique is better for pain relief, we undertook a meta-analysis of all available studies comparing LIA with FNB for patients undergoing TKA. The hypothesis of our study was that LIA could achieve better pain relief than FNB after TKA.

2. Methods

This meta-analysis was done in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [16] guidelines.

2.1. Search strategy

A fully recursive literature search was conducted in PubMed, the Cochrane Library, EMBASE, Web of Science up to October 2014. The search items were "peripheral nerve blocks, femoral nerve block, nerve block, local infiltration, wound infiltration, periarticular, intraarticular, knee, arthroplasty and replacement" in combination with the medical subject headings. Further articles that were potentially missed by the search strategy were identified by a manual search of the references from the key articles, related letters, reviews, and editorials. All the searches were conducted independently by two authors without language and publication status restrictions. Differences were resolved by discussion with the third authors.

2.2. Inclusion criteria and study selection

The inclusion criteria for this meta-analysis were comparative studies that compared LIA with FNB for patients with TKA.

The evaluated outcomes were visual analog score (VAS), opioid consumption, length of hospital stay, complications [including venous thromboembolism (VTE), infection]. Studies that reported at least one outcome were included and trials published without the outcome measures of interest were excluded. Two authors independently assessed potentially relevant citations for inclusion and disagreements were resolved with a third author.

2.3. Data abstraction and quality assessment

The extraction of the data was performed independently by 2 reviewers. For each outcome, the number of patients in each treatment arm was extracted for an intention-to-treat analysis. Data unavailable in the included studies were obtained by direct contact with and authorization of the study steering committees. Any disagreement was resolved by consensus or discussion with the other authors.

Study quality was judged by using the Jadad five-point scale [17] for RCTs and the Newcastle-Ottawa Scale [18] quality assessment scale for nRCTs. The Jadad five-point scale contained two questions each on randomization and masking and one question on the reportin of dropouts and withdrawals. The Newcastle-Ottawa Scale assesses population selection, comparability of exposed and unexposed, and adequacy of outcome assessment (including outcome ascertainment and attrition). Discrepancies were resolved by consensus after discussion with the third author.

We used the Grading of Recommendations Assessment, Development and Evaluation (GRADE) [19] criteria to evaluate the quality of evidence according to outcomes.

2.4. Statistical analysis and subgroup analysis

Data from all eligible trials were analyzed by Review Manager 5.2. If there were continuous scales of measurement, the mean difference (MD) or standard mean difference (SMD) was recommended to assess the treatment with 95% confidence interval [CI]. For dichotomous outcomes, results were expressed as odds ratio (OR). Data was pooled using the fixed-effect model but the random-effects model was also considered to ensure robustness of the model. Heterogeneity between trials was assessed by the I^2 index, which measures the percentage of the variability in effect estimates that are attributable to heterogeneity. In case of significant heterogeneity, results of the random-effect model were noted. Subgroup analysis was conducted to investigate possible reasons for heterogeneity.

3. Results

3.1. Search results

Among 180 potentially eligible articles that were searched in the databases, we excluded 89 duplicates and 75 citations after screening the titles and abstracts. After reading full texts, 6 citations, which did not fulfill inclusion criteria, were excluded. Nine studies [10–15,20–22] with 782 patients fulfilled our criteria and were included in the analysis (Fig. 1).

Table 1 summarises the characteristics of the 9 included studies. Seven studies was RCTs and the remaining 2 studies was nRCT. The studies were published between 2007 and 2014 and the number of participants per study ranged from 32 to 200. The 9 trials enrolled 782 patients with a mean age of 69.1 years.

The quality scores of the nine trials are summarized in Table 1. The total scores of the seven RCTs showed that the quality of the five trials is high (Jadad score = 5). The last two trials [11,20] were lower quality randomized control trials, due to a lack of information on the blinding of participants. According to the Newcastle-Ottawa Scale, one study [12] scored eight points, which meant that the included trials had high quality while another one [13] was low (score = 5) (Table 1).

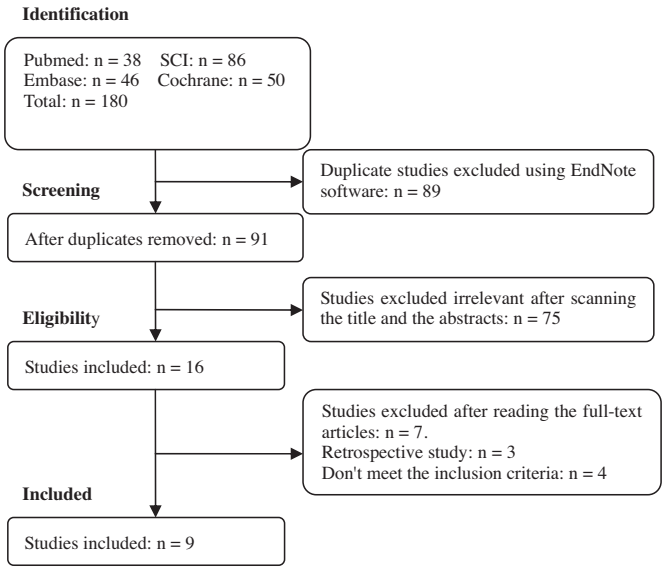

Fig. 1. The flow chart of literature screening.