

# Effects of adductor canal block versus femoral nerve block in patients with anterior cruciate ligament reconstruction

## A protocol for a systematic review and meta-analysis

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### Abstract

**Objective:** It is reported that both adductor canal block (ACB) and femoral nerve block (FNB) are commonly used methods for postoperative analgesia in anterior cruciate ligament (ACL) reconstruction. Currently, no record has compared the efficacy of postoperative pain relief and the influence to quadriceps strength between them. This study aims to provide a protocol to compare the efficacy and safety between ACB and FNB for the postoperative analgesia of ACL reconstruction.

**Methods:** This study will be performed in accordance with the guideline of the Preferred Reporting Items for Systematic Review and Meta-analysis Protocols. Online databases including PubMed, Embase, Web of Science, Cochrane Library, Wanfang database, and the Chinese National Knowledge Infrastructure database will be systematically searched from their inception up May 31, 2019. All randomized controlled trials will be included in present meta-analysis. The quality of enrolled literatures will be evaluated by using the Cochrane Collaboration Risk of bias Tool. Statistical analysis will be calculated by the Review Manager 5.3.

**Results:** This review will investigate the efficacy and safety of ACB compared with FNB in patients undergoing ACL reconstruction. The primary outcomes are visual analog scale, cumulative opioid consumption during 24 hours after surgery, numerical rating scale, and the time to first straight-leg raise. The secondary outcomes include maximal voluntary isometric contraction, stretching torque at 3, 6 months' follow-up, and adverse effects.

**Conclusion:** Findings of this systematic review and meta-analysis will summarize the current evidence in postoperative analgesia for ACL reconstruction and also provide implications for clinical practice.

**Abbreviations:** ACB = adductor canal block, ACL = anterior cruciate ligament, FNB = femoral nerve block, NRS = numerical rating scale, RCTs = randomized controlled trials, VAS = visual analog scale.

**Keywords:** adductor canal block, anterior cruciate ligament reconstruction, femoral nerve block, pain relief, quadriceps strength

## 1. Introduction

Anterior cruciate ligament (ACL) reconstruction is a common procedure in sports medicine which is often accompanied by

considerable early postoperative pain.<sup>[1]</sup> Generally, patients with ACL reconstruction have expectations for a rapid return to daily life. The inadequate postoperative pain relief can lead to poor joint mobility and thus result in the development of adhesions, weakened ligament insertion, and muscle atrophy. Therefore, postoperative pain management plays a critical role in the rehabilitation of patients undergoing ACL reconstruction.<sup>[2]</sup> Recently, peripheral nerve blocks such as femoral nerve block (FNB) and adductor canal block (ACB) for postoperative pain management in ACL reconstruction have become popular because of their ability to reduce requirements of opioids and the risk of opioid related side effects.<sup>[3]</sup>

FNB shows superior analgesia when compared with placebo, and continuous intra-articular and wound infusion after ACL reconstruction.<sup>[4–6]</sup> Furthermore, subjects with FNB have a reduction of opioid requirements in knee surgery.<sup>[7]</sup> Although FNB plays an important role in postoperative analgesia after ACL reconstruction, its influence to quadriceps strength remains controversial. Magnussen et al demonstrated that FNB led to quadriceps strength reduction and poorer KOOS symptom subscale score at 6 weeks following ACL reconstruction.<sup>[8]</sup> In addition, patients treated with FNB after ACL reconstruction had significant isokinetic deficits in knee extension and flexion strength at 6 months.<sup>[9]</sup> Conversely, Stebler et al reported that a continuous FCB was unable to result in worsened functional

XL and JZ contributed equally to this study.

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outcomes after ACL reconstruction.<sup>[10]</sup> ACB is a motor-sparing method which mainly blocks the saphenous nerve and the nerve to vastus medialis while passing through adductor canal.<sup>[11]</sup> It is well established that ACB is a valuable adjunct for post-operative analgesia after major knee surgery.<sup>[12]</sup> Similar to local infiltration analgesia, ACB performs a satisfactory pain analgesia after ACL reconstruction.<sup>[13,14]</sup>

Numerous systematic review and meta-analyses have compared the efficacy of pain control and the influence to quadriceps strength between them in total arthroplasty.<sup>[15–18]</sup> To the best of our knowledge, there is no systematic review and meta-analysis that compares the effect of analgesia and the influence to quadriceps strength between ACB and FCB after ACL reconstruction. Currently, several RCTs have investigated the discrepancy between them in pain relief and functional recovery after ACL reconstruction.<sup>[19–23]</sup> However, consensus regarding the optimal management of postoperative pain and quadriceps strength in this setting is still lacking. The aim of this study is to systematically review available RCTs to assess the efficacy of postoperative analgesia and the influence to quadriceps strength of ACB compared to FCB after ACL reconstruction.

## 2. Methods

### 2.1. Study registration

This study protocol has been registered in the PROSPERO and the registration number is CRD42019134810. This study will be performed and reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses diagnostic test accuracy criteria.

### 2.2. Ethics

Ethical approval or patient consent is not required because the present study is a review of previously published articles.

### 2.3. Eligibility criteria

The eligibility criteria are summarized using PICOS approach (patients, intervention, comparisons, outcome, and study design type).

**2.3.1. Participants.** Patients undergoing primary or revision ACL reconstruction will be included. There will be no restrictions on age, gender, and ethnicity.

**2.3.2. Interventions.** The patients in intervention group are treated with ACB after ACL reconstruction.

**2.3.3. Comparisons.** The patients in control group receive FNB after ACL reconstruction.

**2.3.4. Outcomes.** The primary outcomes include visual analog scale (VAS), cumulative opioid consumption during 24 hours after surgery, numerical rating scale (NRS), and the time to first straight-leg raise. The secondary outcomes are maximal voluntary isometric contraction, stretching torque at 3, 6 months' follow-up, and adverse effects such as postoperative infection, vomiting, and arthrofibrosis.

**2.3.5. Study design.** RCTs published with no language restriction up to May 31, 2019 will be considered eligible for our study.

### 2.4. Data sources and search strategy

We will follow the Preferred Reporting Items for Systematic Review and Meta-analysis Protocols (PRISMA) statement to report this system review. PubMed (1966–May 2019), Embase (1980–May 2019), and Cochrane Library (1966–May 2019) databases is comprehensively searched. The key words include “anterior cruciate ligament reconstruction,” “femoral nerve block,” or “adductor block,” and “randomized controlled trials (RCTs).” The following articles including case reports, reviews, retrospective studies, letters, and animal experimental studies will be excluded in present study.

### 2.5. Study selection and data extraction

**2.5.1. Study selection.** Initial search records will be performed by 2 reviewers (XL and JZ) independently. Two reviewers will independently screen the titles and abstracts. The full text will be read if records meet the predefined inclusion criteria. The flowchart of study selection is shown in Figure 1.

**2.5.2. Data extraction.** Two investigators (XL and JZ) will independently extract the following data from the included literatures: surname of the first author, publication year, sample size, sex ratio, age, and detail methods in each group. All study characteristics will be summarized in the same standardized collection form. Any disagreement between investigators will be resolved by discussion. When necessary, a third investigator (HS) will help reach a consensus with all investigators.

### 2.6. Risk of bias assessment

Two authors will evaluate the risk of bias of each RCT by the Cochrane Risk of Bias tool.<sup>[24]</sup> Each article will be assessed based on the following 7 items: allocation concealment, double blindness, incomplete outcome, selective reporting, randomization process, and measurements of outcomes and other bias. Each item will be described as a low risk of bias, a high risk of bias, or an unclear risk of bias.

### 2.7. Statistical analysis

All statistical analyses will be conducted by Review Manager 5.3 (Cochrane Collaboration, Software Update, Oxford, UK). Continuous data will be assessed using mean difference (MD) with corresponding 95% confidence interval (CIs). Dichotomous data will be calculated using relative risk and 95% CIs.  $P$  value  $<.05$  is regarded as statistically significant. The statistics and quantity of heterogeneity will be estimated depending on the value of  $P$  ( $P_Q$ ) and  $I^2$  using the standard  $\chi^2$  test and  $I^2$  statistic, respectively. When  $I^2 >50\%$  and  $P_Q <.1$ , the heterogeneity will be considered to be significant and then a random effect-model will be used. Otherwise, a fixed-effect model will be chosen.

## 3. Discussion

ACL reconstruction is often associated with moderate-to-severe postoperative pain. A favorable analgesia will improve the satisfaction of patients undergoing ACL reconstruction. ACB and FNB are 2 commonly used methods for postoperative analgesia after ACL reconstruction. Recently, there are several prospective clinical trials exploring the analgesia and strength in patients with ACB or FNB, whereas the results are still controversial. It is necessary to perform such systematic review and meta-analysis to

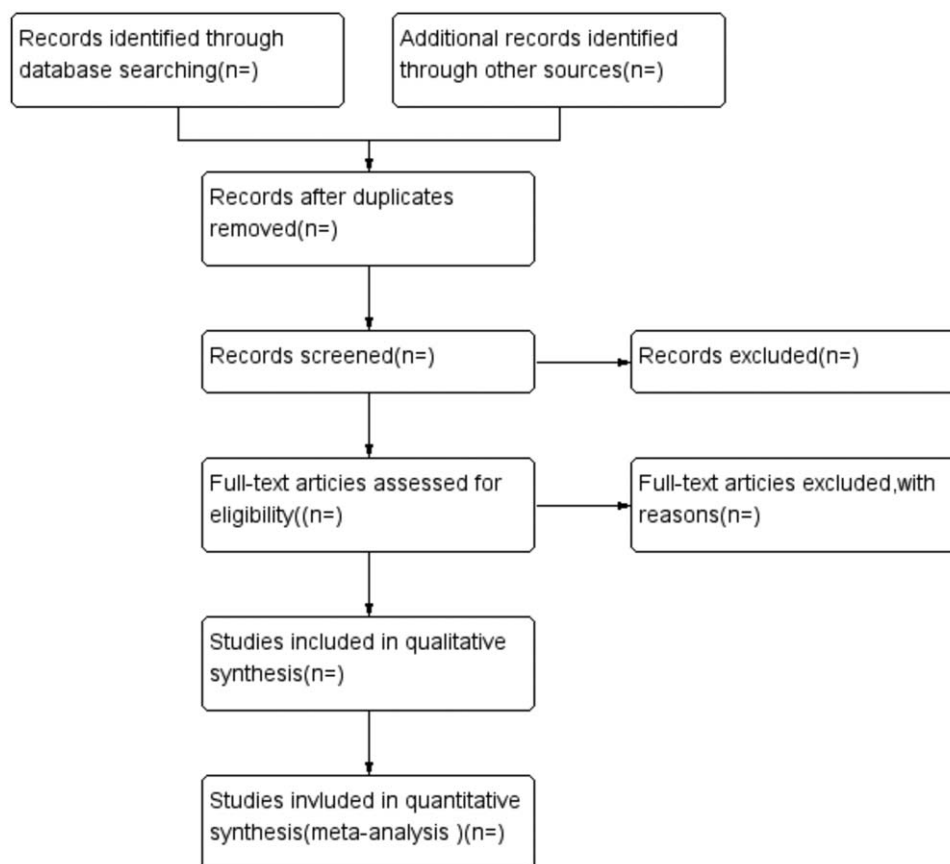


Figure 1. The flowchart of study selection.

analysis the difference between ACB and FNB. To our knowledge, this is the first systematic review and meta-analysis to compare ACB with FNB for the efficacy of pain management and the influence to quadriceps strength in patients with ACL reconstruction. This study will be conducted in accordance with the guideline of the PRISMA. The result will bring a comprehensive comparison to determine which option is better for the postoperative analgesia after ACL reconstruction. The findings of this study may provide helpful evidence for clinical practice.

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