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Comparison of Analgesic Efficiency between Local Infiltration of a Long-Acting Analgesic and Regional Nerve Block among Patients Undergoing Arthroscopic Anterior Cruciate Ligament Reconstruction: Meta-Analysis of Randomized Controlled Trials

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Background: Arthroscopic anterior cruciate ligament (ACL) reconstruction is gaining popularity. Different kinds of anesthetic techniques are used; however, regional nerve block (RNB) such as femoral nerve block is considered the most popular choice. The purpose of this study was to compare the effectiveness of long-acting local anesthesia infiltration (LAI) versus RNB used to control pain and reduce opioid consumption in patients undergoing arthroscopic ACL reconstruction.

Methods: We conducted a meta-analysis using a comprehensive literature search of Google Scholar, PubMed, Medline, and Cochrane Library. All randomized trials comparing the use of infiltration anesthesia versus RNB in patients undergoing arthroscopic ACL reconstruction were included. Methodological quality, risk of bias, and grade of the eligible studies were assessed by 3 independent reviewers. The risk of bias was analyzed using contour-enhanced funnel plots.

Results: The search yielded 671 records. Eight studies were included in the systematic review. The study focused on the assessment of immediate, 24-hour, and 48-hour postoperative pain scores and total opioid consumption. There was no significant difference between the use of LAI and RNB with regard to the immediate ($p = 0.962$), 24-hour ($p = 0.156$), and 48-hour postoperative pain scores ($p = 0.216$). The results suggested that LAI could lead to a similar level of opioid consumption as RNB ($p = 0.304$). However, there was considerable heterogeneity in the opioid consumption outcome due to the different anesthetic techniques used in the included studies.

Conclusions: Regarding postoperative pain control, LAI showed similar clinical effects when compared to the conventional RNB, while maintaining a similar level of opioid consumption postoperatively, decreasing the risk of any adverse effects of morphine. In summary, LAI offers a simpler method of achieving pain relief without the motor weakness associated with RNB. It also allows surgeons to perform ACL reconstruction in institutions without specialized anesthesia for RNB.

Keywords: *Arthroscopic anterior cruciate ligament reconstruction, Regional nerve block, Adductor canal nerve block, Femoral nerve block, Infiltration analgesia*

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Anterior cruciate ligament (ACL) tears have an overall incidence of 68.6 per 100,000 and are more common in males than in females with a peak age of 19–25 years.[1] The standard for treatment strategies for ACL tears has been nonoperative management with quadricep and hamstring strengthening exercises, but arthroscopic ACL reconstruction is gaining popularity in recent years.[1] The type of anesthesia used is a crucial factor for the postoperative pain control. The procedure usually results in significant discomfort for the patient, which is due to the presence of synovial tissues, fat pad, and joint capsule, which are sensitive to painful stimuli.[2,3] After an operation of the knee, chemical mediators such as neuropeptides namely vasoactive intestinal peptide and substance P are released, causing pain in the area due to its nociceptor sensitization.[4]

The use of peripheral nerve block, specifically femoral nerve block, has been considered the most popular choice for the control of pain among patients who underwent ACL reconstruction. The femoral nerve block is believed to provide adequate pain relief, allowing the patient to resume mobilization faster; however, it is accompanied by quadriceps weakness or paresis, leading to delayed mobilization and increased fall risk due to isokinetic deficits in knee extension and flexion strength.[2] The use of an adductor canal block (ACB) provides a comparable analgesia block at the operative area with the advantage of avoiding motor blockade of the quadriceps muscles.[3] However, newer studies suggest that the use of ACB leads to a decrease of knee flexor strength at 6 months.[5] According to the study done by Lynch and Runner, the use of femoral nerve block and ACB provides similar efficacy with regard to postoperative pain scores among patients who underwent arthroscopic ACL reconstructions.[2]

The use of local anesthesia infiltration (LAI) is another option that involves injecting a long-acting local anesthetic in the knee joint, specifically the harvest site and soft tissue around it.[6-8] This technique is an alternative that provides an easier way to administer analgesia with the elimination of the motor weakness caused by the use of a regional nerve block (RNB). It also provides the opportunity for surgeons to perform arthroscopic ACL reconstruction in an institution not equipped with specialized anesthesia doing a RNB. Several randomized controlled trials (RCTs) have attempted to define the optimal analgesic approach with regard to pain control and total opioid consumption of patients of all ages and sexes undergoing arthroscopic ACL Reconstruction, but failed to demonstrate consistent results.[6]

The purpose of this study was to compare the effectiveness of postoperative LAI versus RNB for pain control in patients who underwent arthroscopic ACL reconstruction. The researchers hypothesized that the use of LAI would provide similar pain control and amount of opioid consumption postoperatively when compared to RNB.

METHODS

This study was performed in accordance with the Cochrane Handbook for Systematic Reviews of Interventions and the Preferred Reporting Items from Systematic Reviews and Meta-Analyses statement. Ethical approval and patient consent were not required since this study is a meta-analysis based on published studies.

Eligibility Criteria and Study Inclusion

This meta-analysis included randomized trials involving patients who underwent ACL reconstruction and comparing RNB and infiltration anesthetic injection. The inclusion criteria for the population were patients of all ages and both sexes who underwent arthroscopic ACL reconstruction. The study compared the intervention group of postoperative LAI versus the control group of postoperative RNB. Patients who underwent a procedure other than ACL reconstruction were excluded. The primary outcome in this meta-analysis was the postoperative visual analog scale (VAS) or numeric rating scale (NRS) of immediately, 24 hours, and 48 hours after ACL reconstruction. The secondary outcome was the quantification of opioid analgesic use postoperatively. All RCTs were included in this meta-analysis. The search was performed and limited only to English language. Duplicates were removed and retrieved references were screened in 2 steps: the first step was to screen titles/abstracts for matching the inclusion criteria and the second step was to screen the retrieved full-text articles for eligibility for meta-analysis.

Search Methods for Identification of Studies

The study was based on a comprehensive literature search using Google Scholar, PubMed, Medline, and Cochrane Library and included RCTs as well as previous meta-analyses. Studies that compared RNB versus LAI among patients who underwent arthroscopic ACL reconstruction in terms of VAS or NRS pain scores and postoperative opioid consumption were identified. The main key search terms used were as follows: ACL reconstruction, RNB, ACB, femoral nerve block, infiltration analgesia, and infiltration anesthesia. The articles gathered were limited to the English language only. Two independent reviewers (CFF and BSA) first screened the search results from each of the databases by title and abstract alone. Studies that did not satisfy the inclusion criteria or that included any of the exclusion criteria were not included in the meta-analysis. This screening process included removing duplicate studies that had the same population, intervention, control, and outcome. Potentially relevant articles were then reviewed and subsequently screened by way of full-text eligibility. Any discrepancies were resolved between the authors as to whether the study would be excluded or removed.

Data Extraction

The researchers gathered all available data from the literature collected that had passed the initial screening. Information from the original studies was extracted based on their relevance to the topic regarding the comparison of analgesic efficiency between LAI and RNB among patients undergoing ACL reconstruction. Non-relevant studies or data such as those of patients undergoing surgeries other than arthroscopic ACL reconstruction were disregarded. Parameters collected for comparison between the 2 techniques included postoperative pain score using VAS/NRS and quantification of opioid analgesic use postoperatively.

Risk of Bias Assessment

The researchers appraised the risk of bias for all studies collated based on guidelines in the Cochrane Handbook. This involved proper randomization and blinding of the participants, surgeons, and outcome evaluators. Data extracted and methods were reviewed by 2 main authors (CFF and BSA). The presence of bias was further subdivided into low risk, unclear risk, or high risk. Any study with high-risk bias in even 1 category was categorized to high risk of having bias. Studies in the low-risk group were those that had low-risk bias for all categories. Otherwise, they were classified to the unclear risk group. Disagreements on the classification of bias scoring or data were discussed between the authors.

Statistical Analysis

Statistical analyses were performed using Stata MP–Parallel Edition Statistical Software, version 18 (Stata Corp.). A p-value ≤0.05 was considered statistically significant. A random effects model, using the Mantel-Haenszel model, was employed in the analysis since the study did not assume 1 effect size among all the studies. This type of model in meta-analysis takes within-study and between-study variation into account. The means and standard deviations of the study's outcome variables were utilized to compute for the standardized mean difference (SMD). Statistical heterogeneity between studies was scrutinized using Q statistics test, I^2 statistics, and tau squared (τ^2) statistics.[9) Publication bias was evaluated using contour-enhanced funnel plots, Egger's regression asymmetry test, and Begg's adjusted rank correlation test.[10)]

RESULTS

Search Results

Results of the literature search (a total of 671 potential records) (Fig. 1) were identified from the databases, and 466 studies were excluded for not meeting the PICOM (Population, Intervention, Comparison, Outcome, Methodology) requirements after screening the title and the abstract. In all, 16 full-text articles were assessed for eligibility, of which 2 trials were excluded due to the modified intervention group and 2 studies were excluded because of insufficient data. Four studies were excluded due to multiple sites of regional block. The remaining 8 studies were included in this meta-analysis and systematic review.

Characteristics of Included Studies

The 8 studies were all RCTs (Table 1).[3,11-17)] Two studies were conducted in the United States, 4 in Europe (Germany, France, and United Kingdom: n = 2), 1 in Canada, and 2 in Asia (Thailand and Japan). All the above-mentioned articles were published in English with publication time from 2003 to 2023.

Risk of Bias in Included Studies

The risk of bias analysis using contour-enhanced funnel plots is presented in Fig. 2. As illustrated, there was graphical evidence of funnel asymmetry for 2 variables, 48-hour postoperative pain and opioid consumption, with some studies suppressed on a single side (left side of the plot). These results indicate that the likelihood of publication bias was somewhat high. However, the results of the Begg's and Egger's test showed that publication bias was not statistically significant (Table 2). These results indicate that the likelihood of publication bias was low. The studies were analyzed by the authors using the risk of bias graph presented as percentages and a bias summary for each risk of bias across all included studies (Fig. 3).

Clinical Effects

Pain scores immediately, 24 hours, and 48 hours after surgery

It can be gleaned from Fig. 4 that analysis of the pooled data of immediate postoperative pain showed insignificant SMD between intra-articular LAI and RNB using random effects model (SMD = –0.01, z = 0.05, p = 0.962; 95% CI, –0.26 to 0.25). This finding denotes that immediate postoperative pain was not statistically different between the 2

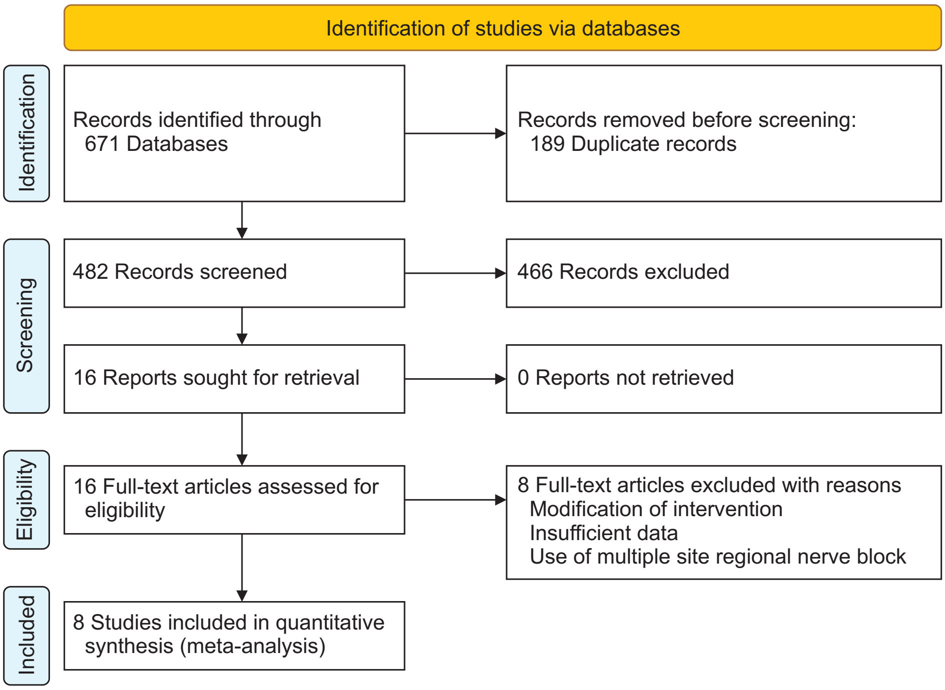

Fig. 1. Flow diagram for selecting studies.

groups. Similarly, the 24-hour (SMD = –0.26, z = 1.42, p = 0.156; 95% CI, –0.62 to 0.10) and the 48-hour postoperative pain scores (SMD = 0.59, z = 1.24, p = 0.216; 95% CI, –0.34 to 1.52) between the LAI and RNB groups were not statistically significantly different. It is also interesting to note that heterogeneity analyses suggest high between-study variations for immediate, 24-hour, and 48-hour postoperative pain scores. The Q-statistic for immediate postoperative pain was 13.14 (p = 0.041), suggesting that the true effect size varied between studies. This result was supported by the I^2 statistic, which was 54.40%, indicating the variability caused by difference in effect sizes (between-study variance) was 54.40% and the remaining 45.60% was due to sampling error (within-study variance). The τ^2 statistic was 0.06, indicative of small heterogeneity among the studies. On the other hand, heterogeneity for the 24-hour postoperative pain was 76.70% (Q = 25.71, p = 0.001, τ^2 = 0.17), while heterogeneity for the 48-hour postoperative pain was 95.40% (Q = 87.26, p = 0.001, τ^2 = 1.07), indicating high heterogeneity among the included studies.

Pain scores for all RCTs for the immediate, 24-hour, and 48-hour postoperative period were monitored by using the standard VAS scoring system (0–100) or NRS (0–10) after arthroscopic ACL reconstruction. In the previous meta-analysis done by Kirkham, which included 11 trials and 628 patients,[6)] the use of femoral nerve block was more effective in controlling postoperative pain during the immediate, 24-hour, and 48-hour period after arthroscopic ACL reconstruction when compared to LAI, with mean differences (95% CI) of 1.6 (range, 0.2–2.9; p = 0.02), 1.2 (range, 0.4–1.5; p = 0.002), and 0.7 (range, 0.1–1.4; p = 0.03), respectively. After including newer RCTs done by Kurosaka et al.[17)] with a total of 129 patients and Stebler et al.[3)] with a total of 98 patients, our meta-analysis showed that the use of LAI had no significant difference for controlling pain immediately, 24 hours, and 48 hours after ACL reconstruction. The RCT done by Kurosaka et al.[17)] included 129 patients (69 in the LAI group and 60 in the femoral nerve block group). Their study concluded that the use of LAI had significantly lower pain scores immediately postoperatively (30 mm vs. 39 mm, p < 0.025), 24 hours postoperatively (21 mm vs. 39 mm, p < 0.001), and 48 hours postoperatively (22 mm vs 32 mm; p = 0.002) when compared to femoral nerve block.

Opioid consumption

Analysis of the pooled date for opioid consumption of patients who received intra-articular LAI and RNB is presented in Fig. 5. As illustrated, the SMD was 0.52, favoring the use of RNB (z = 1.03, p = 0.304; 95% CI, –0.47 to 1.51); however, results were not statistically significant. The analysis also showed a heterogeneity of 95.30%, with a Q-statistic of 85.18 (p = 0.001) and a τ^2 of 1.21, indicative of high heterogeneity among the included studies. In a study by Kurosaka et al.,[17)] opioid consumption was also noted to be higher with the use of femoral nerve block when compared to LAI. On the other hand, the RCT done by Stebler

Table 1. Characteristics of the Included Studies

Study	Group (n)	Study design	Population	Intervention	Control	Rescue opioid medication	Adverse effect	Outcome: Postoperative pain	Outcome: Opioid analgesic use
Iskandar et al. (2003)[11]	Total: 80, intervention: 40, control: 40	RCT	ASA I patients scheduled to undergo elective ACL reconstruction (hamstring)	LAI: 20 mL of 1% ropivacaine	FNB: 20 mL of 1% ropivacaine	Morphine 2 mg; VAS > 3 via PCA pump	Nausea and sedation (higher for LAI)	VAS (0–100 mm) Immediate, 24 hr, 48 hr	Yes
Mehdi et al. (2004)[12]	Total: 50, intervention: 25, control: 25	RCT	Underwent anterior cruciate ligament reconstruction (BPTB)	LAI: 40 mL of 0.25% bupivacaine	FNB: 30 mL of 0.375% (112 mg) bupivacaine	-	-	VAS (0–100 mm) immediate, 24 hr	No
Woods et al. (2006)[13]	Total: 90, intervention: 45, control: 45	RCT	15 Years or older receiving arthroscopically assisted anterior cruciate ligament reconstruction (BPTB)	LAI: 20 mL of 0.5% bupivacaine with epinephrine (1 : 200,000)	FNB: 30–40 mL of 0.5% ropivacaine; 100 µg of clonidine; continuous infusion of 0.2% ropivacaine at 4 mL/hr (24 hr)	-	-	VAS (10 cm) 48 hr	No
Mayr et al. (2007)[14]	Total: 157, intervention: 55, control: 53	RCT	Patients who underwent arthroscopic ACL reconstruction (BPTB)	LAI: 0.1 mg of fentanyl + 8 mL of 0.5% bupivacaine	FNB: 0.1 mg of fentanyl + 8 mL of 0.5% bupivacaine	-	-	VAS (0–10) Immediate, 24 hr	No
Kristensen et al. (2014)[15]	Total: 60, intervention: 30, control: 30	RCT	>18 Years undergoing primary ACL reconstruction (hamstring)	LAI: 20 mL of 2 mg/mL ropivacaine with 5 µg/mL epinephrine	FNB: 20 mL of 2 mg/mL ropivacaine	Morphine 5–10 mg for pain > 3; Fentanyl 50 µg/mL for pain > 5	Nausea, vomiting, fatigue, dizziness and itching (similar for both groups)	NRS (0–10) immediate, 24 hr, 48 hr	Yes
Iamaroon et al. (2016)[16]	Total: 40, intervention: 20, control: 20	RCT	ASA I-II patients, ACL reconstruction: 18 years and above (BPTB)	LAI: 20 mL of 0.25% bupivacaine	FNB: 20 mL of 0.25% bupivacaine	Morphine IV 3 mg	None	NRS (0–10) immediate, 24 hr	Yes
Kurosaka et al. (2018)[17]	Total: 129, intervention: 60, control: 69	RCT	>13 Years scheduled for primary ACL reconstruction (hamstring)	LAI: 40 mL of 7.5 mg/mL ropivacaine; 0.5 mL of 10 mg/mL morphine hydrochloride hydrate; 1.0 mL of 40 mg methylprednisolone; 2.5 mL of 20 mg/mL ketoprofen; 0.2 mL of 1 mg/mL epinephrine	FNB: 10–30 mL of 2.5–3.75 mg/mL ropivacaine (computed based on patient body weight requirement)	Fentanyl 20 µg/hr; PRN for severe pain (PCA)	Nausea or vomiting (similar to both groups)	VAS (0–100 mm) immediate, 24 hr, 48 hr	Yes
Stebler et al. (2019)[3]	Total: 98, intervention: 49, control: 49	RCT	18 Years and above for elective primary ACL reconstruction (hamstring)	LAI: 20 mL of 0.5% ropivacaine	ACB: 20 mL of 0.5% ropivacaine	Morphine 2 mg; PRN pain > 3 (PCA)	Nausea or vomiting (similar to both groups)	NRS (0–10) immediate, 24 hr, 48 hr	Yes

RCT: randomized controlled trial, ASA: American Society of Anesthesiologists Physical Status Classification, ACL: anterior cruciate ligament, LAI: local anesthesia infiltration, FNB: femoral nerve block, VAS: visual analog scale, PCA: patient-controlled analgesia, BPTB: bone patellar tendon bone (graft), NRS: numeric rating scale, PRN: pro re nata (as needed), ACB: adductor canal block.

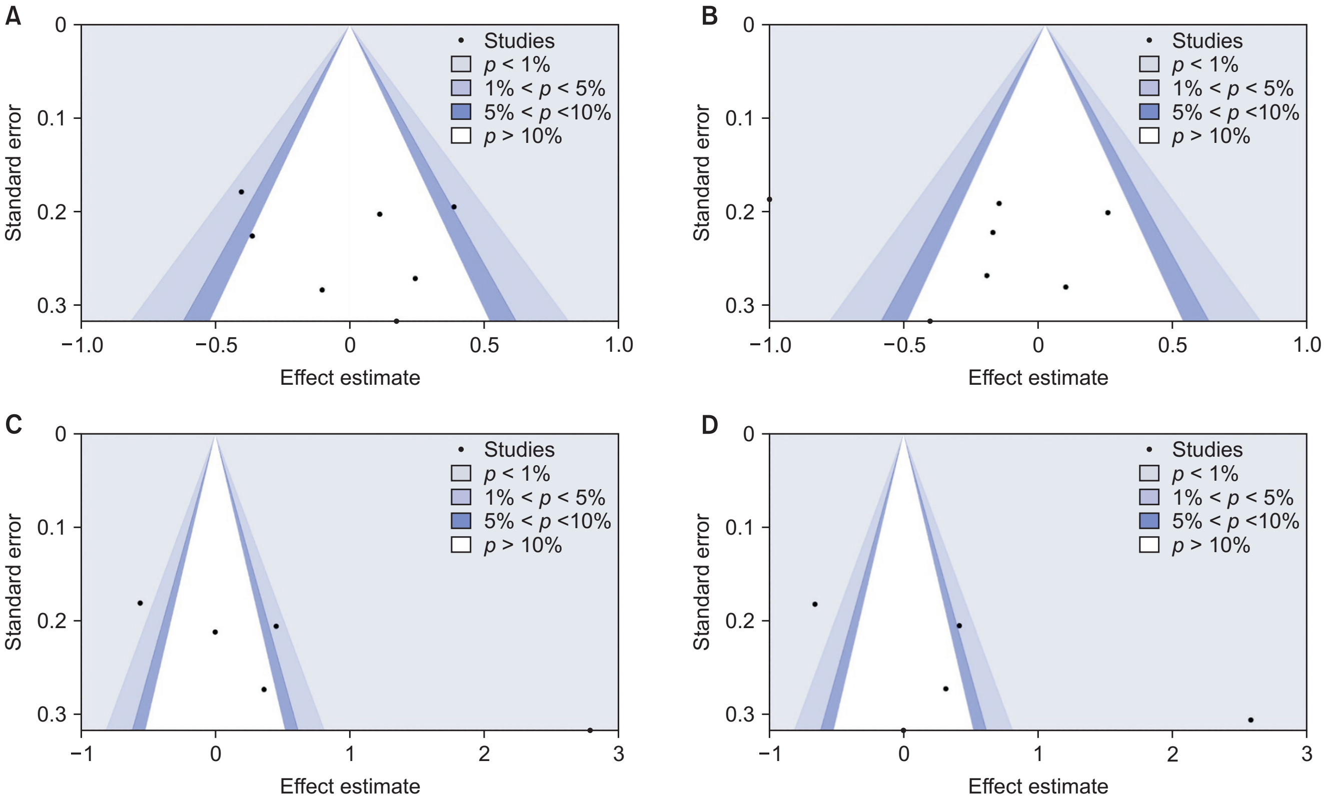

Fig. 2. Contour-enhanced funnel plots for immediate postoperative pain (A), 24-hour postoperative pain (B), 48-hour postoperative pain (C), and opioid consumption (D) among the studies included.

Table 2. Formal Statistical Analysis for Publication Bias Assessment

Outcome variable	Number of studies	Egger's regression asymmetry test		Begg's adjusted rank correlation test	
		z-value	*p*-value (two-tailed)*	Coefficient	*p*-value (two-tailed)*
Immediate postoperative pain	7	1.68	0.610	0.15	0.881
24-Hour postoperative pain	7	2.41	0.618	0.15	0.881
48-Hour postoperative pain	5	18.84	0.056	1.22	0.221
Opioid consumption	5	11.98	0.241	0.24	0.806

*Significant at $p < 0.05$.

et al.[3] showed LAI and the use of ACB showed similar or no significant difference when it comes to controlling postoperative pain using pain score and total opioid consumption (ACB group: 17.1 mg [95% CI, 13.1 to 21.2], LAI group: 17.7 mg [95% CI, 13.2 to 22.6]; $p < 0.84$).

DISCUSSION

All RCT studies included post-ACL reconstruction patients of all ages and sexes with a total of 704 patients (LAI group, n = 324; RNB group, n = 380). Four studies used the bone patellar tendon bone grafting technique with a total of 337 patients (LAI group, n = 145; RNB group, n = 192) while the remaining 4 used hamstring tendons as their graft with a total of 367 patients (LAI group, n = 179; RNB group, n = 188).

Among the different RCTs included in the study, 7 studies used femoral nerve block as their anesthetic of choice for the control group.[11-17] On the other hand, in a study by Stebler et al.,[3] they used an ACB for their RNB

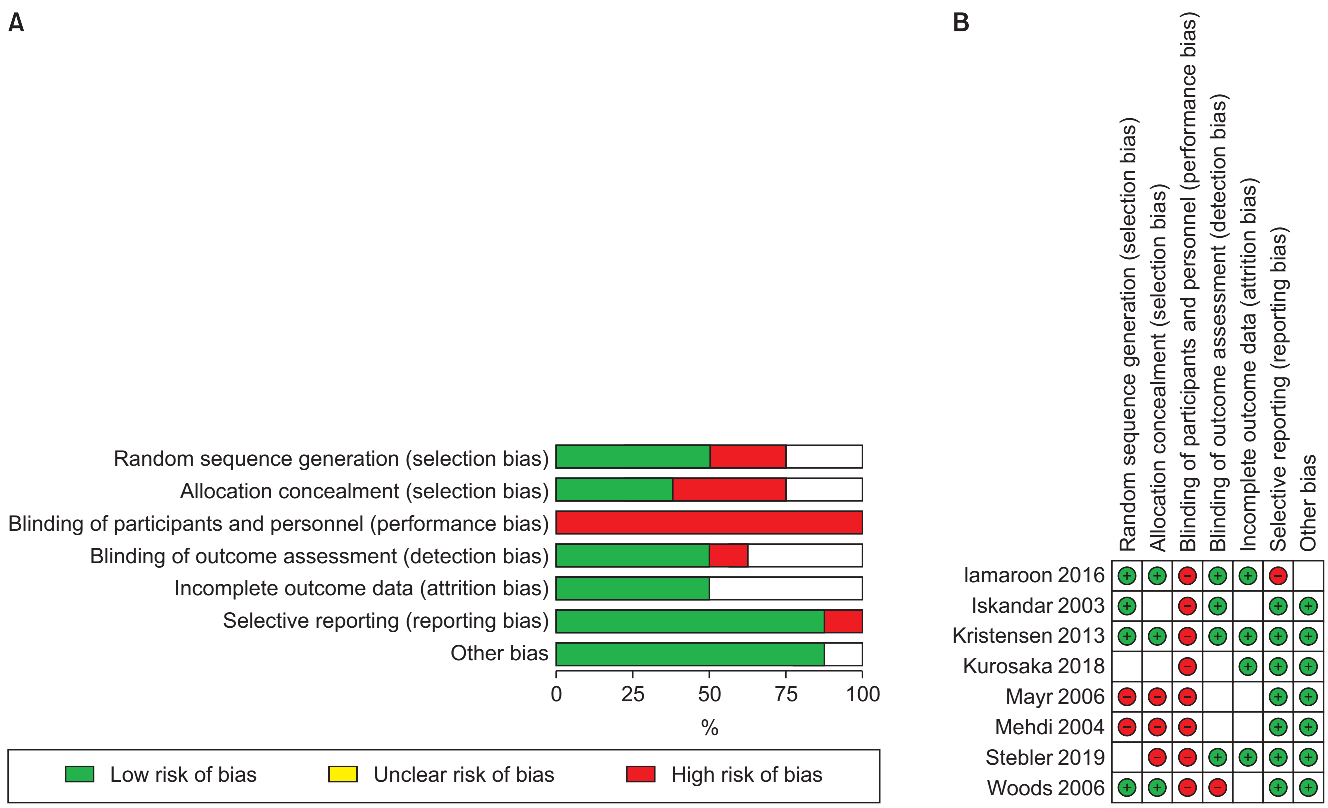

Fig. 3. (A) Risk of bias graph presented as percentage across all included studies. (B) Risk of bias summary for each risk of bias item in all included studies.

control group. This study was included due to the fact that the utilization of an ACB offers comparable analgesia in the operative region among ACL patients, with the added benefit of avoiding motor blockade in the quadriceps muscles. Nevertheless, recent studies indicate that employing ACB may result in a reduction in knee flexor strength after 6 months leading to the assumption that both femoral nerve block and ACB may lead to motor weakness after surgery, leading to decreased functional recovery and delay of rehabilitation.[3,5]

The intervention group all comprised of local infiltration using long-acting analgesics such as bupivacaine or ropivacaine with or without morphine, ketoprofen, fentanyl, methylprednisolone, or epinephrine (Table 1) at the harvest sites and synovium around the knee articular surface. All available information regarding concentration and drug combinations from all studies for both groups are also shown in Table 1. Four studies only included pure dosage of long-acting analgesics (2 bupivacaine and 2 ropivacaine) without any adjunctive drugs in the solution used.[3,11,12,16] Two studies done by Woods et al.[13] and Kristensen et al.[15] both used a solution of a long-acting analgesic with an adjunct of epinephrine. A study by Mayr et al.[14] used an 8 mL of 0.5% bupivacaine solution with 0.1 of mg fentanyl as an adjunct. Lastly, a study by Kurosaka et al.[17] used 40 mL of 7.5 mg/mL ropivacaine combined with multiple adjuncts such as 0.5 mL of 10 mg/mL morphine hydrochloride hydrate, 1 mL of 40 mg of methylprednisolone, 2.5 mL of 20 mg/mL of ketoprofen, and 0.2 mL of 1 mg/mL epinephrine.

The need for further opioid rescue medication was assessed in 5 studies.[3,11,15-17] As shown in Table 1, 3 studies used morphine as needed for severe pain. The study by Kurosaka et al.[17] used 20 μg of fentanyl via a patient-controlled analgesia pump as needed for severe pain. While the study by Kristensen et al.[15] used both morphine and fentanyl as the rescue opioids, morphine was given 5–10 mg as needed for pain > 3, while fentanyl was given at 50 μg/mL for pain > 5. Adverse events such as nausea, sedation, fatigue, and vomiting related to opioid consumption were assessed in 4 studies.[3,11,15,17] The study by Iskandar et al.[11] showed higher adverse reaction events for the LAI group compared to the RNB group. However, the rest of the 3 studies noted a similar rate of adverse events for both groups.[3,15,17]

For assessment of pain, the studies used the NRS

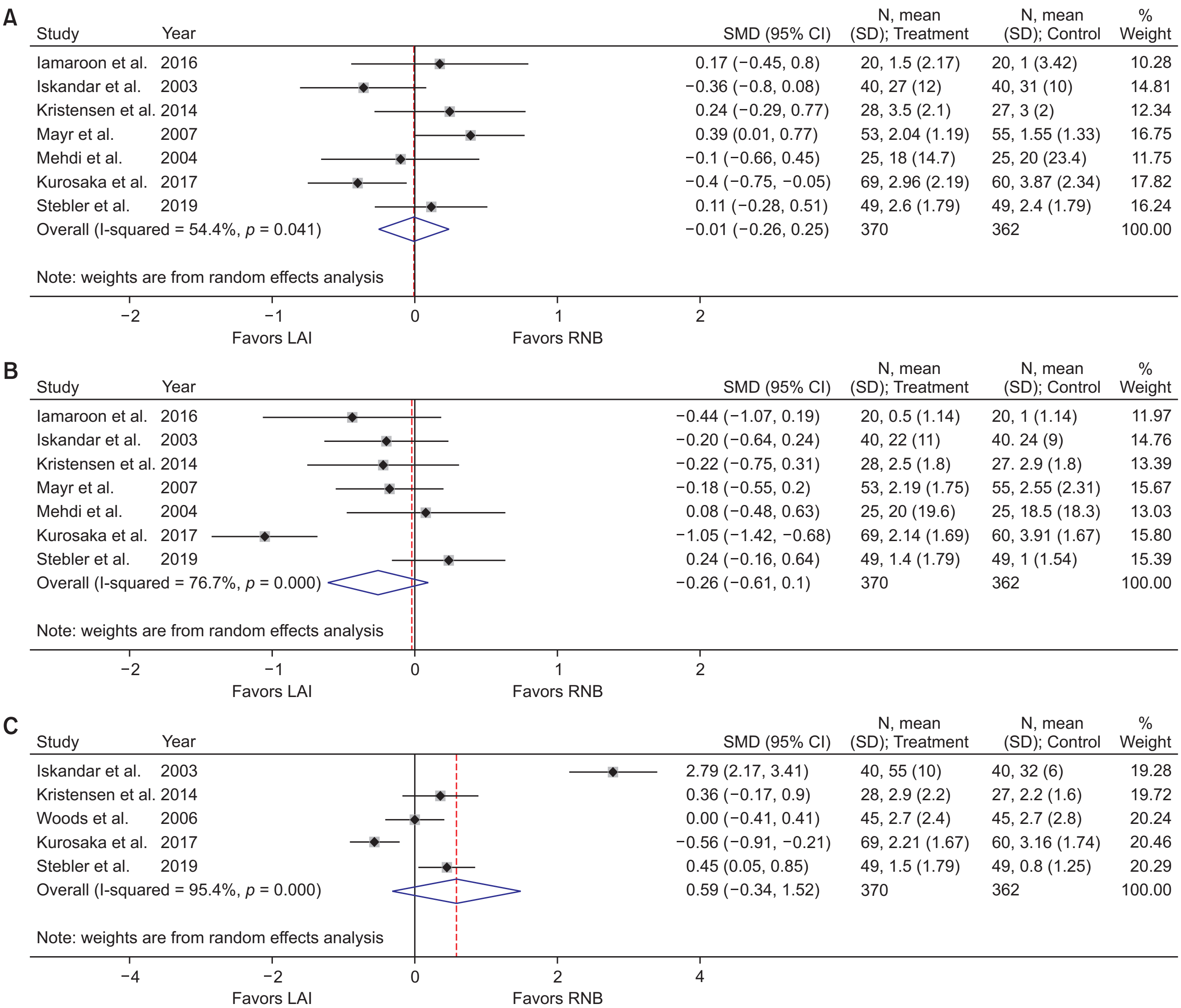

Fig. 4. Comparison of mean immediate postoperative pain scores (A), mean 24-hour postoperative pain scores (B), and mean 48-hour postoperative pain scores (C) between local anesthetic infiltration (LAI) and regional nerve block (RNB). SMD: standardized mean difference, SD: standard deviation.

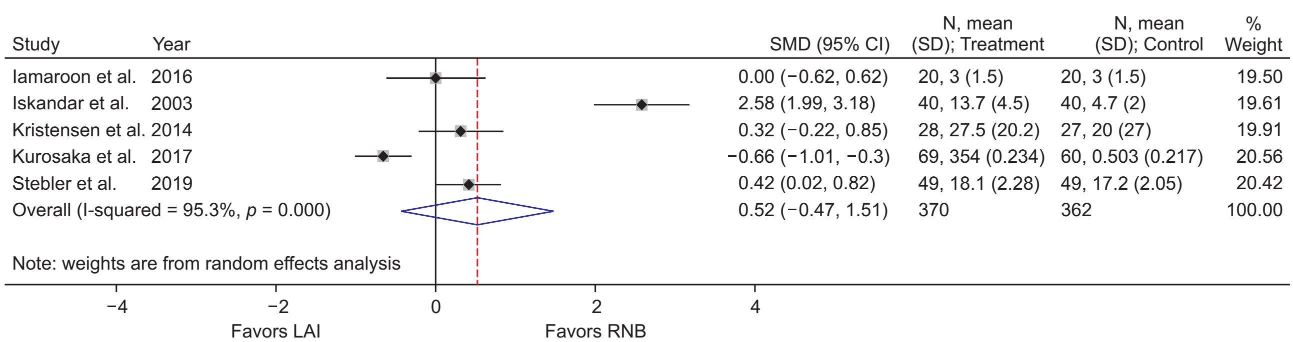

Fig. 5. Comparison of mean opioid consumption between local anesthetic infiltration (LAI) and regional nerve block (RNB). SMD: standardized mean difference, SD: standard deviation.

(rated 0–10) or the VAS pain scale (rated 0–100) as their outcome, which were both validated with very strong association with each other as they measure the same parameters for pain.[18] Five studies used the VAS scoring system, while 3 studies used the NRS scoring system. None of the patients were noted to have any cognitive impairment preventing any inaccuracy in assessment. The VAS score (0–100) was converted to a scale of 0–10 by dividing the score by 10 to have a uniform statistical analysis for the outcome of this meta-analysis.

This meta-analysis was able to synthesize findings for immediate, 24-hour, and 48-hour postoperative pain scores, as well as total opioid consumption postoperatively. The conventional RNB group reported no significant difference in postoperative pain scores based on pain scoring compared to the LAI group. However, postoperative opioid consumption was significantly higher among patients who underwent LAI compared to patients in the RNB group. The results of this meta-analysis show that the LAI has equivalent results in terms of postoperative pain scores compared to the conventional RNB. The findings suggest that patients undergoing LAI with use of long-acting analgesia such as bupivacaine and ropivacaine could potentially have comparable acute and postoperative pain scores after ACL reconstruction with similar total opioid consumption when compared to patients undergoing RNB.

The generated evidence from this meta-analysis is credible particularly in terms of postoperative pain scores and opioid consumption rates because the results showed statistical homogeneity despite some clinical heterogeneity. This implies LAI is equally effective in decreasing acute and postoperative pain scores, but may potentially lead to a higher opioid consumption rate. In addition, the included studies came from different countries, with varying age groups and types of graft harvesting techniques, allowing for generalizability of the results.

There are several limitations that are worthy to mention in this meta-analysis. There was considerable heterogeneity in the opioid consumption outcome due to the different anesthetic techniques done in the included studies. Different anesthetics used in the study were femoral nerve block, ACL, and a combination of sciatic nerve and femoral nerve block. They also had varying anesthetic doses used in their studies based on the preference of the anesthesiologist. Also, the findings of slightly higher but not significant opioid consumption in the LAI group could have affected the primary outcome of the pain score in the 2 groups. Although helpful in terms of generalizability, the clinical heterogeneity (age of participants, types of control groups, and graft harvesting techniques) may have also caused variability in results.

The choice between LAI and RNB for pain management in ACL reconstruction should be individualized, considering patient preferences, institutional resources, and a balance between pain control and opioid use. Further research in this area is warranted to refine analgesic techniques and optimize outcomes for patients undergoing ACL reconstruction. Regarding postoperative pain control, the LAI group showed similar clinical effects when compared to the conventional RNB group, while maintaining similar opioid consumption postoperatively and decreasing the risk for any adverse effects of morphine. In summary, this technique offers a simpler method of achieving pain relief without the motor weakness associated with RNB. It also allows surgeons to perform ACL reconstruction in institutions without specialized anesthesia for RNB.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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