This article has been accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination, and proofreading processes, which may lead to differences between this version and the version of record.

Please cite this article as https://doi.org/10.4097/kja.21040
FULL TITLE: A comparison of adductor canal block before and after thigh tourniquet during knee arthroscopy: A randomized, blinded study

Mursel Ekinci¹, Bahadir Ciftci¹, Yavuz Demiraran¹, Erkan Cem Celik², Murat Yayik², Burak Omur¹, Ersin Kuyucu³, Yunus Oktay Atalay¹

¹ Department of Anesthesiology, Istanbul Medipol University, School of Medicine, Istanbul, Turkey
² Erzurum Ataturk University Research Hospital, Department of Anesthesiology and Reanimation, Erzurum, TURKEY.
³ Department of Orthopedics and Traumatology, Istanbul Medipol University, School of Medicine, Istanbul, Turkey

A SHORT TITLE: ACB before or after thigh tourniquet

Address correspondence to:
Ciftci, Bahadir, MD
Assist. Prof. Istanbul Medipol University School of Medicine, Department of Anesthesiology and Reanimation
Address: Istanbul Medipol University, School of Medicine, Mega Medipol University Hospital, Department of Anesthesiology and Reanimation, Istanbul, TURKEY
34040, Bagcilar/Istanbul/ TURKEY
Phone: + 90 532 503 44 28
bciftci@medipol.edu.tr, baha_cftci@hotmail.com

Acknowledgements
None

Declaration of interest
The authors declare that they do not have any conflict of interest.

Funding
The authors did not receive any funding to produce this manuscript.

**Authors’ contributions**

Study conception: BC, ME, MY

Study design: BC, ME, YD, ECC, MY, BO, EK, YOA

Participant recruitment: BO, EK, YOA

Data collection: BC, ME, YOA

Data analysis: BC, ME, ECC, MY

Writing up the first draft and the final paper: BC

Revision of drafts: YD, YOA

Final approval: BC, ME, YD, ECC, MY, BO, EK, YOA
Effect of adductor canal block done before vs. after thigh tourniquet inflation in knee arthroscopy: a randomized, blinded study

Adductor canal block before or after inflation of thigh tourniquet
Abstract

**Background:** Adductor canal block (ACB) provides effective analgesia management after arthroscopic knee surgery. However, there is insufficient data about performing ACB before or after inflation of a thigh tourniquet. We aimed to investigate the efficacy of ACB when it is performed before and after thigh tourniquet and evaluate motor weakness.

**Methods:** ACB was performed before the tourniquet inflation in the PreT group, it was performed after the inflation of the tourniquet in the PostT group. In the PO group, ACB was performed at the end of surgery after disinflation of the tourniquet.

**Results:** There were no statistical differences between the groups in terms of demographic data. Opioid consumption showed no statistically significant differences (for total consumption; \( p = 0.5 \)). The amount of rescue analgesia administered and patient satisfaction were also not significantly different between groups. There was no significant difference in terms of static and dynamic VAS scores between groups (for 24 hours; \( p = 0.3 \), \( p = 0.2 \) respectively). The incidence of motor block was higher in the PreT group (eight patients) than in the PostT group (no patients) and in the PO group (only one patient) (\( p = 0.005 \)).

**Conclusions:** Using a tourniquet before or after ACB may not result in any differences in terms of analgesia; however, applying a tourniquet immediately after ACB may lead to muscle weakness.

**Keywords:** Adductor canal block; knee arthroscopy; thigh tourniquet, motor weakness, regional anesthesia, postoperative analgesia.
Introduction

Arthroscopic knee surgery is a routine orthopedic procedure performed to repair meniscus tears, debride/reshape cartilage flaps, and reconstruct ligaments [1-3]. Although it is a minimally invasive procedure, patients may still complain about moderate-to-severe pain due to the port-site incision and surgical trauma to the ligaments of the knee joint. Pain after arthroscopic knee surgery not only results in patient dissatisfaction but also may cause delayed mobilization. Therefore, it is important to manage postoperative pain [3-5]. Analgesia after this type of surgery can be provided most effectively with a peripheral nerve block as part of a multimodal analgesia regimen. Peripheral nerve blocks such as femoral nerve block or adductor canal block (ACB) may be an option for pain management [6-8]. However, motor blockade of the quadriceps muscle after a femoral nerve block may create a potential risk for falls [9].

The adductor canal is a musculoaponeurotic tunnel functioning as a passageway for neurovascular structures (the femoral artery, femoral vein, saphenous nerve and the nerve to the vastus medialis) from the femoral triangle to the adductor hiatus [10]. It has been shown that selective blockade of the saphenous nerve in the adductor canal provides effective analgesia management after surgical knee procedures [4-15]. Because the saphenous nerve is a sensory branch of the femoral nerve, ACB has potential advantages over femoral block by avoiding motor blockade of the quadriceps muscle and providing early ambulation [16].

Thigh tourniquet is commonly used during knee surgeries to reduce intraoperative blood loss and improve surgical outcomes [17-19]. Although it has been shown in a cadaveric study that thigh tourniquet significantly increased the proximal–distal distribution of radiopaque dye within the adductor canal, there is insufficient data about the resulting quadriceps weakness when the local anesthetic agent spreads proximally [18]. We hypothesized that performing ACB before or after
inflation of a thigh tourniquet may also affect the spread of the local anesthetic agent, which may affect analgesia and quadriceps weakness. Thus, our study aimed to investigate the ideal performing time for ACB: when it should be performed; before or after thigh tourniquet.
Materials and Methods

This randomized prospective, exploratory study was approved by the Istanbul Medipol University Ethics and Research Committee. Following approval, the study was registered at ClinicalTrials.gov (registration number: NCT04010916). The Consolidated Standards of Reporting Trials (CONSORT) flow diagram chart was used for the enrollment of patients (Fig. 1). Written informed consent was obtained from all patients in this study. The study took place between July 2019 and October 2020 at Medipol University Hospital.

Ninety patients aged 18–65 years with American Society of Anesthesiologists (ASA) class I and II physical status who were scheduled for unilateral arthroscopic knee surgery were enrolled in the study. Patients with a history of bleeding diathesis; patients who were pregnant or breastfeeding; patients with a history of anticoagulant treatment, allergy to local anesthetic or opioids or infections at the block performance area; and patients who refused block performance were excluded from the study. Using a computerized randomization program, the patients were equally divided into three groups (n = 30 in each group) according to the time of ACB performance: the pre-tourniquet ACB group (PreT group), the after-tourniquet ACB group (PostT group) and the postoperative ACB group (PO group).

General Anesthesia

After standard ASA monitoring in the operation room (electrocardiography, noninvasive blood pressure, and pulse oximetry (SPO2)) and premedication with 2 mg of intravenous (IV) midazolam, anesthesia induction was performed with intravenous propofol (2–2.5 mg kg\(^{-1}\)), fentanyl (1–1.5 µg kg\(^{-1}\)) and rocuronium bromide (0.6 mg kg\(^{-1}\)). Sevoflurane in a mixture of 50% air–oxygen with 2–3 L min\(^{-1}\) of fresh gas flow was used to maintain anesthesia. Analgesia was provided with a remifentanil infusion at a rate of 0.01–0.1 µg kg min\(^{-1}\) during the surgery.
presence of an increase in heart rate and a mean arterial pressure above the baseline level, fentanyl (1 μg kg⁻¹) was used. All personnel in the operating room were blinded to the randomization of the patients. All surgical procedures were performed by the same surgical team using the same technique. At the end of the surgery, the neuromuscular blockade was antagonized using IV atropine (0.01 mg kg⁻¹) and neostigmine (0.05 mg kg⁻¹). The patients were extubated after exhibiting sufficient spontaneous respiration and were transferred to the post-anesthesia care unit (PACU). After they attained a modified Aldrete score of 9 or above, the patients were discharged from the PACU.

**Adductor Canal Block Procedure**

After general anesthesia, all blocks were performed with ultrasound guidance (Vivid q US device, GE Healthcare, Wauwatosa, WI) with a high frequency (12 mHz) linear US probe and a 22G, 50-mm block needle (Stimuplex Ultra 360; B. Braun, Melsungen, Germany). While ACB was performed before the tourniquet inflation in the PreT group, it was performed after the inflation of the tourniquet in the PostT group. In the PO group, ACB was performed at the end of surgery after disinflation of the tourniquet. The participants did not know which group they were assigned to.

**PreT group:** ACB was performed preoperatively and before inflation of the tourniquet. The thigh tourniquet was inflated immediately after performing ACB in the PreT group.

**PostT group:** ACB was performed preoperatively and after inflation of the tourniquet.

**PO group:** ACB was performed postoperatively after disinflation of the tourniquet.

The thigh tourniquet was inflated to 250-300 mmHg on the proximal aspect of the thigh using an electronic tourniquet system, supported with an Esmarch bandage, and applied during the surgery.¹⁶,¹⁷
The US probe was placed at the mid-thigh, half the distance between the inguinal crease and the patella, and the adductor canal was identified (Figure 2). After visualization of the pulsatile superficial femoral artery dorsal to the sartorius muscle, the probe was moved in the distal direction. At this level, the saphenous nerve was visualized as a hyperechoic structure lateral-anterior to the artery in the subsartorial region [4,5,11]. By using the in-plane technique, the injection site was confirmed with an injection of 5 mL of saline, and then 30 ml of 0.25% bupivacaine was injected (Figure 3).

Outcomes and assessments—postoperative analgesia management, dermatomal testing and motor block evaluation

The primary outcome was postoperative (24 h) opioid consumption, secondary outcomes were postoperative pain scores (VAS), motor blockade, and adverse effects related to opioids (e.g. allergic reaction, nausea and vomiting).

A standardized, postoperative pain management protocol was used for the study. Twenty minutes before the end of the surgery, 400 mg ibuprofen and 100 mg tramadol IV was administered. Ibuprofen 400 mg IV was ordered for every 8 hours in the postoperative period. A patient-controlled analgesia (PCA) pump releasing only fentanyl (10 µg ml⁻¹) was attached to all patients with a 2-ml bolus without infusion, a lockout time of 20 minutes and a four-hour limit. Pain evaluation was performed with the visual analog scale (VAS; 0 = no pain, 10 = most severe pain). Static (at rest) and dynamic (during mobilization) VAS scores were recorded at 0 (PACU), 2, 4, 8, 16, and 24 hours postoperatively. If the VAS was 4 or greater with the routine analgesia protocol, only meperidine (0.5 mg kg⁻¹) IV was administered as a rescue analgesic. Postoperative opioid consumption was evaluated and recorded at 0–8, 8–16, and 16–24 h time intervals. Any opioid-
related adverse effects, such as nausea, vomiting or itching, were also recorded. The outcomes were evaluated and recorded by a single pain nurse anesthetist, who was blinded to the study.

Dermatomal testing was evaluated with a pinprick sensation test 20 minutes after the surgery along the field of the saphenous nerve (the medial infrapatellar region and the medial malleolus) by an anesthesiologist who did not participate in and was blinded to the study. The loss of sensation in the corresponding area was considered a successful block [4]. Motor block evaluation was performed once by an orthopedic surgeon who was blinded to the study 20 minutes after the surgery. For motor block evaluation, the patient was asked to extend his/her knee in full flexion, and the block was classified as grade 0 (normal muscle power), grade I (motor weakness) or grade II (complete motor paralysis) [20].

Sample size calculation and statistical analyses

The primary aim of the study was to compare the consumption of fentanyl among the three groups 24 hours postoperatively. To determine the required sample size, a preliminary study was performed with 30 patients. While the mean fentanyl consumption was around 48 ± 16.8 µg in the PreT group (n = 10), it was 32 ± 13.9 µg in the PostT group (n = 10) and 36 ± 24.5 µg in the PO group (n = 10). For total opioid consumption, a sample size of 81 was calculated using GPower (version 3.1.9.2, Dusseldorf, Germany) with an alpha probability of 0.05, a power of 0.95 and a medium-large effect size (0.4) [21]. Considering possible dropouts, we included 30 patients in each group to attain higher power for a total of 90 patients.

Statistical analysis was performed using the IBM SPSS v20.0 (IBM SPSS Statistics Inc., Chicago, Illinois, USA) software package. The normality distribution of variables was checked with the Kolmogorov–Smirnov test and histogram. Descriptive data were expressed as mean ± standard deviation or median (interquartile range; q1, q3). Categorical variables were analyzed using the
Pearson chi-square test. Normally distributed data comprising continuous variables were analyzed using the one-way ANOVA test abnormally distributed data comprising continuous variables were analyzed using the Kruskal-Wallis test to check the differences between groups. A p-value of less than 0.05 was considered statistically significant.
Results

The CONSORT flow diagram in Figure 1 describes the patients enrolled in the study. This randomized study included 90 patients with 30 in each of three groups (the PreT group, the PostT group and the PO group). There were no statistical differences between the groups in terms of demographic data, anesthesia duration or length of surgery (Table 1). The ACB was achieved successfully in all patients.

Opioid consumption, the primary outcome of the study, during all time intervals showed no statistically significant differences (for total consumption; p = 0.5). Total consumption was 40 μg (20, 60) in PreT group, 40 μg (20, 40) in PostT group, 40 μg (20, 60) in PO group. The number of patients who received rescue analgesia (17 patients in PreT group, 15 patients in PostT group, and 18 patients in PO group) and patient satisfaction were also not significantly different between groups (Table 2). There was no significant difference in terms of static and dynamic VAS scores between groups (for 24 hours; p = 0.3, p = 0.2 respectively).

The incidence of motor block was higher in the preT group (eight patients) than in the postT group (no patients) and in the PO group (only one patient) (p = 0.005) (Table 4). The postoperative incidence of side effects related to opioids was also not significantly different between the groups (Table 5).
**Discussion**

The present study evaluated the efficacy of ACB when it is performed before vs. after thigh tourniquet inflation in patients undergoing arthroscopic knee surgery. The results of this study showed there were no differences between groups in terms of either opioid consumption or pain scores. According to our results, applying thigh tourniquet immediately after ACB contribute to the occurrence of motor blockade.

Local anesthetic agent distribution through the adductor canal is very important because it may affect both the analgesic efficacy of ACB and quadriceps weakness. The distribution of local anesthetic agent to distal locations (popliteal fossa) through the adductor canal may affect the analgesic efficacy of ACB after knee surgery [22]. The adductor canal extends to the apex of the femoral triangle; therefore, larger volumes of local anesthetic agent or continuous infusion may result in the blockage of the femoral nerve [18,23]. The predictive factors in the distribution of local anesthetic agent may be the injection location, the volume of local anesthetic agent and whether the local anesthetic agent is given as a bolus or a continuous infusion [22,24]. In a study investigating the distribution of injectate and sensory-motor blockade, Gautier et al. [22] found that 20 mL of local anesthetic resulted in spread into the popliteal fossa. On the other hand, Andersen et al. [19] found that 15 mL of dye was sufficient to spread both proximally and distally through the adductor canal. Jaeger et al. tried to find the minimal effective volume (dose) of lidocaine 1% to fill the adductor canal, and came to the conclusion that the minimum effective dosage (ED95) was just 20 mL [23]. According to Jaeger et al., there was no correlation between volume, proximal spread and muscle strength. Anatomical differences and the fascia associated with the adductor canal may be predictors of the spread of local anesthetics [23]. The similarity of these studies is that tourniquet was not used in any of them. However, the presence of thigh tourniquet may be another factor that can affect local anesthetic or dye distribution. Nair et al. investigated the effect of thigh tourniquet
on the distribution of local anesthetic within the adductor canal and found a combined superior-inferior dye distribution in cadavers [18]. In this study, the authors injected 25 mL of radio-opaque dye into the adductor canal and applied the tourniquet immediately after the ACB to reflect clinical practice. They found that tourniquets significantly increased dye distribution proximally–distally. In that cadaveric study, authors concluded that the pressure created with the tourniquet may have increased the spread of local anesthetic within the adductor canal.

As an explanation for motor weakness in PreT group, the pressure of inflated tourniquet immediately after performing ACB may increase the spread of local anesthetic within the adductor canal proximally–distally. Our results support the findings of cadaveric study performed by Nair et al [18]. This may be a result of the spread of local anesthetic to the motor fibers of femoral nerve throughout the adductor canal.

This study has some limitations. Firstly, we measured motor block only once, 20 minutes after the surgery. It would be better to know the period of weakness of the motor weakness after surgery. Secondly, the assessment for motor weakness was subjective, not objective. Further studies may be performed with objective motor weakness tests. Lastly, because we tested the motor function just 20 minutes after surgery and the reversal of muscle relaxation was not confirmed by a test, residual relaxation by intraoperative muscle relaxant administration might affect the outcome of motor function assessment.

In conclusion, using a tourniquet before or after ACB or providing ACB at the end of surgery after disinflation of the tourniquet may not result in any differences in terms of analgesia; however, applying a tourniquet immediately after ACB may lead to motor blockade. Further studies with lower volumes of analgesic are needed.
References


<table>
<thead>
<tr>
<th></th>
<th>PreT Group (n:30)</th>
<th>PostT Group (n:30)</th>
<th>PO Group (n:30)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) a</td>
<td>40.2 ± 11.30</td>
<td>39.8 ± 9.6</td>
<td>38.7 ± 10.7</td>
<td>0.856</td>
</tr>
<tr>
<td>Weight (kg) a</td>
<td>77.2 ± 8.2</td>
<td>76.7 ± 10.7</td>
<td>74.4 ± 11.8</td>
<td>0.529</td>
</tr>
<tr>
<td>Height (cm) a</td>
<td>172.7 ± 6.5</td>
<td>172.4 ± 8.8</td>
<td>168.4 ± 9.7</td>
<td>0.093</td>
</tr>
<tr>
<td>Gender (M/F) b</td>
<td>18/12</td>
<td>16/14</td>
<td>14/16</td>
<td>0.585</td>
</tr>
<tr>
<td>ASA (I/II) b</td>
<td>17/13</td>
<td>22/8</td>
<td>17/13</td>
<td>0.307</td>
</tr>
<tr>
<td>Duration Time of Surgery (min) a</td>
<td>71.4±15.7</td>
<td>70.6±15.8</td>
<td>68.7±19.8</td>
<td>0.819</td>
</tr>
<tr>
<td>Duration Time of Anesthesia (min) a</td>
<td>81.7±15.2</td>
<td>83.0±18.6</td>
<td>77.6±21.9</td>
<td>0.507</td>
</tr>
</tbody>
</table>

Values are expressed mean ± standard deviation or number, kg; kilogram, cm; centimeter, M; male, F; Female, ASA; American Society of Anesthesiologist, min: minutes. aOne-Way ANOVA analysis of variance with Tukey’s method, bPearson Chi-square test, *Two sided P value >0.05
Table 2: The comparison of opioid consumption (fentanyl) and use of rescue analgesia (meperidine) (number of patients) between groups.

<table>
<thead>
<tr>
<th></th>
<th>PreT Group (n:30)</th>
<th>PostT Group (n:30)</th>
<th>PO Group (n:30)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-8 h (µg)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0(0, 20)</td>
<td>0(0, 20)</td>
<td>0(0, 20)</td>
<td>0.114</td>
</tr>
<tr>
<td>8-16 h (µg)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20(20, 40)</td>
<td>20(0, 20)</td>
<td>20(20, 40)</td>
<td>0.221</td>
</tr>
<tr>
<td>16-24 h (µg)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0(0, 20)</td>
<td>0(0, 20)</td>
<td>0(0, 20)</td>
<td>0.318</td>
</tr>
<tr>
<td>Total Consumption (µg)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>40(20, 60)</td>
<td>40(20, 40)</td>
<td>40(20, 60)</td>
<td>0.513</td>
</tr>
<tr>
<td>Rescue Analgesia&lt;sup&gt;b&lt;/sup&gt;</td>
<td>17</td>
<td>15</td>
<td>18</td>
<td>0.730</td>
</tr>
<tr>
<td>Patient Satisfaction (medium / good / excellent)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6/18/6</td>
<td>4/10/16</td>
<td>4/16/10</td>
<td>0.104</td>
</tr>
</tbody>
</table>

Values are expressed as median (Q1, Q3) or number, h; hours, µg; microgram. <sup>a</sup>Kruskal- Wallis H test with Dunn’s procedure, <sup>b</sup>Pearson Chi-square test. *Two sided P value >0.05
Table 3: The comparison of postoperative VAS values in rest and dynamic between groups.

<table>
<thead>
<tr>
<th>VAS(^a)</th>
<th>PreT Group (n:30)</th>
<th>PostT Group (n:30)</th>
<th>PO Group (n:30)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest PACU</td>
<td>1(1, 3)</td>
<td>2(1, 2)</td>
<td>2(1, 3)</td>
<td>0.562</td>
</tr>
<tr>
<td>2(^{nd}) hours</td>
<td>2(1, 3)</td>
<td>2(2, 2)</td>
<td>2(2, 3)</td>
<td>0.146</td>
</tr>
<tr>
<td>4(^{th}) hours</td>
<td>1(1, 2)</td>
<td>2(1, 2)</td>
<td>2(1, 2)</td>
<td>0.160</td>
</tr>
<tr>
<td>8(^{th}) hours</td>
<td>2(1, 2)</td>
<td>2(1, 2)</td>
<td>2(1, 2)</td>
<td>0.064</td>
</tr>
<tr>
<td>16(^{th}) hours</td>
<td>1(0, 1)</td>
<td>1(1, 1)</td>
<td>1(0, 1)</td>
<td>0.286</td>
</tr>
<tr>
<td>24(^{th}) hours</td>
<td>0(0, 1)</td>
<td>0(0, 1)</td>
<td>0(0, 0)</td>
<td>0.306</td>
</tr>
<tr>
<td>Dynamic PACU</td>
<td>2(2, 4)</td>
<td>3(2, 3)</td>
<td>3(2, 4)</td>
<td>0.143</td>
</tr>
<tr>
<td>2(^{nd}) hours</td>
<td>3(2, 4)</td>
<td>3(2, 3)</td>
<td>3(3, 4)</td>
<td>0.125</td>
</tr>
<tr>
<td>4(^{th}) hours</td>
<td>2(2, 2)</td>
<td>2(2, 3)</td>
<td>3(2, 3)</td>
<td>0.071</td>
</tr>
<tr>
<td>8(^{th}) hours</td>
<td>3(2, 4)</td>
<td>3(3, 4)</td>
<td>3(2, 4)</td>
<td>0.084</td>
</tr>
<tr>
<td>16(^{th}) hours</td>
<td>1(1, 2)</td>
<td>2(1, 2)</td>
<td>2(1, 2)</td>
<td>0.140</td>
</tr>
<tr>
<td>24(^{th}) hours</td>
<td>0(0, 1)</td>
<td>0(0, 1)</td>
<td>0(0, 1)</td>
<td>0.271</td>
</tr>
</tbody>
</table>

Values are expressed median (Q1, Q3), h:hours, μg: microgram, VAS:Visual analog pain scale, PACU: Post anesthesia care unit. *Kruskal- Wallis H test with Dunn’s procedure, *Two sided P value >0.05
Table 4: The comparison of postoperative duration of motor block between groups.

<table>
<thead>
<tr>
<th></th>
<th>PreT Group (n:30)</th>
<th>PostT Group (n:30)</th>
<th>PO Group (n:30)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Block (0/1/2)a</td>
<td>15/7/8&lt;sup&gt;b,c&lt;/sup&gt;</td>
<td>23/7/0</td>
<td>21/8/1</td>
<td>0.013&lt;sup&gt;*&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Values are expressed as a number, 0; normal muscle power, I; motor weakness, II; complete motor paralysis.  
<sup>a</sup>Pearson Chi-Square test,  
<sup>b</sup>Two sided p value <0.05 with pearson chi-square test compared with PostT group,  
<sup>c</sup>Two sided p value <0.05 with pearson chi-square test compared with PO group.  
<sup>*</sup>Two sided p value <0.05
Table 5: The Comparison of incidence of side effects between groups.

<table>
<thead>
<tr>
<th></th>
<th>Pre Group (n:30)</th>
<th>Pre-T Group (n:30)</th>
<th>PO Group (n:30)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea (Y/N)a</td>
<td>9/21</td>
<td>5/25</td>
<td>8/22</td>
<td>0.457</td>
</tr>
<tr>
<td>Vomiting (Y/N)a</td>
<td>3/27</td>
<td>3/27</td>
<td>5/25</td>
<td>0.661</td>
</tr>
<tr>
<td>Itching (Y/N)a</td>
<td>2/28</td>
<td>1/29</td>
<td>2/28</td>
<td>0.809</td>
</tr>
</tbody>
</table>

Values are expressed as a number, Y; yes, N; no, *Pearson Chi-Square test, *Two sided p value >0.05
**Figure Legends**

**Figure 1.** CONSORT flow diagram of the study

**Figure 2.** Probe, needle, tourniquet, and patient position.

**Figure 3.** Sonographic anatomy of block. Needle direction, and spread of local anesthetic during block performing. Arrows indicates the needle. A; artery, LA; local anesthetic