Research Article

Efficacy of Periarticular Infiltration with Dexamethasone and Bupivacaine plus Adductor Canal Block Relative to That of Adductor Canal Block Alone for Patients Undergoing Total Knee Arthroplasty: A Retrospective Case-Matched Study

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Purpose. Periarticular infiltration (PI) is a common procedure during total knee arthroplasty (TKA) for postoperative pain management. This retrospective, case-matched study aimed to evaluate the effectiveness of PI with dexamethasone and bupivacaine in combination with an adductor canal block (ACB) and compare it with that of ACB alone in reducing postoperative pain in patients with TKA.

Methods. Data were collected from 66 patients who underwent TKA performed by a single surgeon. Thirty-three of them received ACB + PI, and 33 received ACB alone. However, both groups underwent identical surgical techniques and postoperative care protocols. Pain scores and fentanyl consumption of the two groups were compared.

Results. The ACB + PI group had significantly lower pain scores than the ACB alone group at 8, 16, 24, and 48 hours postoperatively (p = 0.033, 0.004, 0.038, and 0.049, respectively). The percentage of patients requiring fentanyl as a rescue medication was significantly higher for the ACB alone group (90.9%) than for the ACB + PI group (69.7%, p = 0.03). The total fentanyl consumption was also lower for the ACB + PI group (p < 0.001).

Conclusion. The periarticular injection of the combination of dexamethasone and bupivacaine plus ACB was more effective than ACB alone in reducing postoperative pain and fentanyl consumption in patients undergoing TKA. Further studies comparing different doses of dexamethasone or other cocktail regimens may provide additional insights into this approach.

1. Background

After undergoing total knee arthroplasty (TKA), managing pain effectively is crucial as it can markedly influence patient recovery and function [1]. Inadequate pain control after TKA has negative consequences, such as an increased risk of venous thromboembolism, stiff knee, development of chronic pain, and delayed recovery [2, 3]. Various pain management techniques are available for dealing with post-TKA pain, such as pharmacological usage, peripheral nerve blocks, and periarticular injection [4, 5].

The peripheral nerve block is effective in reducing pain after TKA. There are several types of peripheral nerve blocks, such as the femoral nerve block [6], sciatic nerve block [7], and adductor canal block (ACB) [8]. ACB is a type of peripheral nerve block affected by injecting a local anesthetic into the adductor canal, which is located beneath the sartorius muscle [9]. The benefit of ACB over other types of peripheral nerve blocks in TKA is the reduced risk of quadriceps weakness [10]. There is evidence in support of the efficacy of ACB for postoperative pain control after TKA [11].

Periarticular infiltration (PI) is widely performed during TKA. It involves the intraoperative injection of a local anesthetic combined with other medications, such as non-steroidal anti-inflammatory drugs (NSAIDs) or steroids,
into the soft tissue around the knee joint [12, 13]. A peri-
articular injection can be administered by the surgeon
intraoperatively and at a low cost [14].
Several studies have compared the efficacies of PI
combined with ACB and ACB alone for pain management
following TKA, but the results are inconclusive [15, 16].
While some studies have found that the combined approach
leads to improved postoperative pain scores and reduced
morphine consumption compared to ACB alone [17, 18],
others have found no significant difference between the two
methods [19, 20]. In addition, the cocktail formulas used in
these studies varied widely, ranging from local analgesic
drugs alone to combinations with morphine or ketorolac
[16–20].
However, there has been limited research on the effects
of PI with dexamethasone and bupivacaine in patients who
have undergone TKA and have already received ACB. Thus,
the purpose of this study was to evaluate the effect of PI with
dexamethasone and bupivacaine in combination with ACB
on postoperative pain in patients who underwent TKA and
compare it with that of ACB alone.

2. Methods
This was a retrospective, case-matched study that utilized
data extracted from the electronic hospital database of pa-
tients who underwent primary TKA between July 2020 and
June 2022. The local ethics committee and the Institutional
Review Board approved this study, and the requirement for
patient consent was waived.
The inclusion criteria were patients who underwent TKA
for primary osteoarthritis and received a combination of
spinal anesthesia and ACB. Patients with incomplete data,
previous knee surgery, or pain medication protocols that did
not match the study protocol were excluded. Patients who
underwent TKA between July 2020 and December 2020 were
categorized into the control group (patients who had ACB
alone). In contrast, patients who underwent TKA between
January 2021 and June 2022 and received a combination of
PI and ACB were included in the experimental group.
All surgeries were performed by a single surgeon using
a uniform technique (medial parapatellar approach with
lateral patellar subluxation). A cemented posteriorly sta-
lized knee prosthesis was used. The tourniquet was inflated
throughout the surgery. All patients received spinal anes-
thesia and ultrasound-guided ACB. However, patients in the
experimental group received PI with a mixed solution of
0.5% bupivacaine 20 mL, dexamethasone 8 mg, and adren-
aline 0.3 mg in saline solution in a total volume of 100 mL.
Approximately 30 mL of the mixed solution was injected into
the deep tissues around the medial and lateral collateral
ligaments before implant insertion. After the cement was set,
40 ml of the mixture was injected into the joint capsule and
muscle, 10 ml of the mixture was injected into the synovial
tissue at the suprapatellar area, and 20 ml was injected at the
subcutaneous and skin areas.
The same postoperative care and rehabilitation protocols
were applied to all the patients. The patients received
a standardized postoperative analgesic regimen consisting of
oral paracetamol 500 mg every 8 hours and oral pregabalin
50 mg once daily before bedtime. Parecoxib (40 mg) was
administered intravenously every 12 hours in three doses.
For patients older than 65 years and those with body weights
less than 55 kg, the dose was decreased to 20 mg. This was
followed by a switch to oral celecoxib (400 mg) once daily. In
the case of breakthrough pain, intravenous fentanyl was
administered as rescue analgesia.
Following surgery, the patients were instructed to per-
form ankle pumping and quadriceps isometric exercises.
They were provided with a supportive device to assist in
walking, and range of motion exercises were introduced on
the first day after the procedure. The severity of pain was
assessed using a verbal numerical scale score ranging from
0 to 10, with 0 indicating no pain and 10 indicating the worst
imaginable pain. A nurse evaluated the severity of pain at 4-
hour intervals after surgery until the patient was discharged
from the hospital.
An independent t-test was used to compare the patient’s
demographic data, including age, weight, height, body mass
index (BMI), preoperative hemoglobin level, platelet count,
and durations of surgery and hospital stay. The effects of sex,
side of surgery, and American Society of Anesthesiologists
(ASA) classification were assessed using the chi-squared test,
while the pain score and fentanyl consumption were eval-
uated using the Wilcoxon rank-sum test. All statistical
analyses were conducted using R, version 3.1.0 (R Foun-
dation for Statistical Computing, Vienna, Austria). Statis-
tical significance was defined as p ≤ 0.05.

3. Results
We analyzed 66 patients who met the eligibility criteria. The
control group included 33 patients who only received ACB,
whereas the experimental group included 33 patients who
received PI and ACB. Table 1 summarizes the demographic
data of all the patients, which showed no differences between
the groups.
The postoperative pain score was significantly lower in
the PI group at 8, 16, 24, and 48 hours. However, there was
no difference between the pain scores at 36 and 72 hours. The
pain scores are presented in Table 2.
The percentage of patients who required fentanyl as
a rescue medication was significantly higher for those who
received ACB alone (90.9% for the ACB alone group and
69.7% for the ACB + PI group, p = 0.03). The fentanyl
consumption was lower for the patients who had ACB + PI
in all timeframes (Table 3).
The duration of surgery was slightly higher for the
ACB + PI group, but this was not statistically significant
(84.30 ± 26.66 minutes for the ACB alone group and
91.82 ± 20.15 minutes for the ACB + PI group, p = 0.201).
However, the duration of hospital stay (from the day of
surgery until discharge) was significantly lower for the
ACB + PI group (4.24 ± 0.61 minutes for the ACB alone
group and 3.85 ± 0.36 days for the ACB + PI group,
p = 0.02). None of the patients in either group developed
a deep infection or thromboembolism or required
reoperation.
postoperative pain following TKA than ACB alone. The combination of PI and ACB was more effective in controlling pain, but the results were inconclusive [16–20]. In our study, the combination of ACB and periarticular injection was more effective in pain management following TKA.

Several studies have explored the effectiveness of periarticular injections. However, conflicting results may be due to the differences in the medications used for periarticular injections. Further research is necessary to elucidate the effects of periarticular injections.

Our results demonstrated that patients in the periarticular injection group had lower morphine consumption for up to 72 hours postoperatively. Similar to a previous study that used an injection cocktail containing ropivacaine, morphine, and ketorolac, it was found that patients in the periarticular injection group used less hydromorphone on postoperative days 0 and 1 [17]. A small randomized control trial found that patients using levobupivacaine, morphine, and adrenaline had less morphine consumption for up to 6 hours after surgery than in the control group, but the overall morphine consumption of both groups at 24 and 48 hours was not significantly different [19]. These findings suggest that the effectiveness of PI may be influenced by the specific medication administered.

The length of hospital stay is an important outcome measure in patients undergoing TKA. Our study found that patients who received periarticular injections had shorter hospital stays than those in the control group. This contradicted the reports of previous studies, including that conducted by Kampitak et al. [19] and a study using a solution of ropivacaine and adrenaline in 0.9% normal saline [18]. These studies found no significant decrease in the duration of hospital stay for the patients who received periarticular injections of a cocktail of levobupivacaine, morphine, and adrenaline relative to the control group. These conflicting results may be due to the differences in the medications used for periarticular injections. Further research is necessary to elucidate the effects of periarticular injections on the length of hospital stay after TKA.

This study has several limitations that should be acknowledged. First, this was a retrospective study; therefore, the surgeon and the evaluator were not blinded. However, all surgeries were performed by a single surgeon using an injection protocol.
identical protocol, and the protocol for the patients was also identical, except for the addition of periarticular injection in one group. Second, we were only able to analyze pain scores at rest and were unable to assess pain during motion and range of motion because of the limited data available in our electronic database. Future prospective studies should incorporate these in their protocols. Finally, our periarticular injection cocktail contained two active substances: bupivacaine and dexamethasone. Therefore, it is difficult to determine the one with the greatest pain reduction effect after TKA. However, we hypothesized that both substances had synergistic effects on pain control.

5. Conclusions

Our study suggests that periarticular injections of a combination of dexamethasone and bupivacaine, in addition to ACB, are more effective than ACB alone in reducing pain and fentanyl consumption following TKA. These findings highlight the potential benefits of periarticular injections during TKA. However, further studies are needed to investigate the optimal doses of dexamethasone and bupivacaine and compare the efficacies of different cocktail regimens. Overall, our study contributes to the growing body of evidence regarding the use of periarticular injections for pain management after TKA.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon request.

Ethical Approval

This study was approved by the Ethics Committee and Institutional Review Board of the Faculty of Medicine, Prince of Songkla University.

Conflicts of Interest

The authors declare that they have no conflicts of interest with respect to the research, authorship, and/or publication of this article.

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