Intra-articular Bupivacaine versus Bupivacaine plus Dexamethasone for Analgesia after Knee Surgery

Abstract
Background: Postoperative pain is a common problem suffering the patients after knee surgery. Treatment with intra-articular corticosteroid preparation has been advocated but the value of this approach has not been established. We compared the efficacy of intra-articular dexamethasone plus bupivacaine with the efficacy of intra-articular bupivacaine alone to prevent post-operative pain after meniscectomy.

Methods: Sixty ASA1 patients undergoing meniscectomy with general anesthesia were randomly assigned to receive intra-operative intra-articular bupivacaine, bupivacaine plus dexamethasone, or placebo under double blinded condition. The group 1 (n=20) received 10ml of bupivacaine 0.5% with epinephrine 1:2000000, group 2 (n=20) received 8ml bupivacaine 0.5% with epinephrine 1:200000 plus 2ml (8mg) dexamethasone and group 3 (n=20) received 10ml of normal saline. The patients were evaluated until 12 hours after the operation and pain levels at rest measured by a Visual Analogue Scale (VAS).

Results: During the first six hours after the operation, both combination of bupivacaine and dexamethasone and bupivacaine alone significantly reduced patient’s pain (P=0.000) and during six to twelve hours after operation the patients in dexamethasone group had significantly lower pain scores comparing to other group (P=0.037). The low pain scores were associated with lower requirement of supplementary analgesics (P=0.000).

Conclusion: Combination of intra-articular dexamethasone and bupivacaine significantly reduces post-operative pain and consumption of analgesics following meniscectomy than intra-articular bupivacaine alone.

Key words: Intra-articular, Bupivacaine, Dexamethasone, Post-operative pain.

Introduction
The knee is one of the most frequently injured joints because of its anatomical structure, its exposure to external forces and the functional weights placed on it. Different methods have been used for decreasing post-operative pain. In some studies treatment with intra-articular injections of corticosteroid preparations have been
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advocated. One study showed that the intra-articular corticosteroid lead to faster pain relief than physiotherapy in patients with frozen shoulder, and another reported that intra-articular corticosteroids in treatment of osteoarthritis is effective. Dexamethasone is a corticosteroid with potent anti-inflammatory effect that helps to decrease wound pain after oral surgery. Also in one study the use of intra-articular dexamethasone as an alternative for treatment of advanced chronic hemophilic synovitis before doing invasive surgical treatment was performed. It was also successfully used for treatment of chronic arthritis. On the other hand combination of intra-articular bupivacaine and morphine and bupivacaine with fentanyl have been used for postoperative analgesia after knee arthroscopy. Therefore we designed a randomized double-blinded, placebo-controlled study to evaluate the effect of intra-articular administration of dexamethasone on postoperative pain and analgesic requirement after meniscectomy.

Patients and Methods

After approval by the local ethical committee, informed patient consent was obtained from all under studied patients. Sixty ASA physical status I patients, scheduled for meniscectomy under general anesthesia, and were enrolled in this prospective, randomized, double-blinded, placebo-controlled study. Patients with history of gastrointestinal bleeding, known allergy to any drug or those receiving chronic steroid therapy were excluded. All patients were premedicated with midazolam, 1 mg IV and fentanyl 100 μg IV. In all patients anesthesia was induced with thiopental, 5mg/kg. Tracheal intubation was facilitated with succinyl cholin, 1.5 mg/kg, anesthesia and muscle relaxation were maintained with halothane 0.5%, nitrous oxide 50% in oxygen and atracurium 0.3mg/kg. The patients were monitored with pulse oximetry and electrocardiography intra-operatively. At the end of operation after insertion of hemovac drain and repairing of articular capsule, patients were randomized into three groups, and the following solutions were administered: Group 1 (n=20) received 10ml of bupivacaine 0.5% with epinephrine 1:200000, group 2 (n=20) received 8ml bupivacaine 0.5% with epinephrine 1:200000 plus 2ml (8mg) dexamethasone, and group 3 (n=20) received 10ml normal saline intra-articularly.

After administration of solutions the drain was immediately clamped for one hour and then the clamp was removed. The solutions were prepared and coded with another anaesthesiologist in sterile syringes and the contents of them were unknown to the surgeon and observer anaesthesiologist who assessed the patients postoperatively. After the end of operation the patients were assessed and pain levels were measured at 2, 4, 5, 8 and 12 hours after operation, with 0 corresponding to no pain and 10 to the worst imaginable pain.

Before anesthesia, all patients received instructions to use Ten centimeter VAS. The requirements for analgesics were also assessed and if pain relief was insufficient (VAS>4), pethidine 50 mg IM was administered and recorded. VAS scores were recorded in the recovery room (T1), 2h (T2), 4h (T3), 6h (T4), 8h (T5) and 12h after operation.

Demographic data and supplemental analgesic consumption were analysed by using analysis of variance (ANOVA). The VAS scores were analyzed by the Kruskal Wallis test and if a significant difference was obtained, the Mann-Whitney U-test was performed. All data are presented as mean±SD, or median with range for non parametric data. P-values less than 0.05 were considered statistically significant.

Results

Demographic data, duration of surgery and anesthesia, are shown in Table-1. There were no significant differences among groups regarding these data. The average painless time (±SD) in three groups is shown in Table-2. There were no intergroup differences in demographic characteristics, surgery and anesthesia times. The average painless time
(±SD) after operation was significantly higher (P<0.05) in dexamethasone group (574.5±41 min) compared with the group 1 (310±30min) and control group (0). There were significant differences between the three groups. VAS scores at rest are shown in Figure 1. During the first 6 hours after the operation, pain scores were significantly lower in both intra-articular bupivacaine plus dexamethasone and bupivacaine alone groups (versus the control group) (P<0.05), but after 6 hours the patients in dexamethasone group had significantly decreased in dexamethasone group than other groups, (P<0.05) Table 2.

No adverse side effects were noted after the intra-articular administration of this solutions and all patients discharged from the hospital the day after surgery.

Discussion
A recently published article showed that, only a single intra-articular administration of corticosteroid can relieve pain and swelling after the surgery.10 Also combination of bupivacaine and morphine has been successfully used for pain relief after arthroscopy.11

The results showed that the combination of intra-articular bupivacaine and morphine is more effective than bupivacaine or morphine alone for reducing postoperative pain after knee surgery.12 The choice for dexamethasone was made on the basis of its potent anti-inflammatory effect than other corticosteroids.13 It also can inhibit prostaglandin synthesis and increase release of endorphins.14

In this study we found that the intra-articular administration of dexamethasone plus bupivacaine after meniscectomy is effective to reduce pain and swelling as evidenced by both the lower VAS scores and lower need for pethidine in the postoperative period.

We conclude that combination of intra-articular dexamethasone and bupivacaine significantly reduces post operative pain and consumption of analgesics following meniscectomy than intra-articular bupivacaine alone.

<table>
<thead>
<tr>
<th>Table 1: Demographic Data, Duration of Surgery and Anesthesia</th>
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<tbody>
<tr>
<td><strong>Bupivacaine (IA) 0.5% 10ml</strong></td>
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<tr>
<td>---------------------------------</td>
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<tr>
<td>Age (yr)</td>
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<td>Gender (M/F) (n)</td>
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<tr>
<td>Weight (kg)</td>
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<tr>
<td>Surgery time (min)</td>
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<tr>
<td>Anesthesia time (min)</td>
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Values are expressed as mean ±SD and numbers (n).
No differences were found between the three groups.
IA: Intra-articular
### Table 2: The Average Painless Time and Analgesic Consumption

<table>
<thead>
<tr>
<th></th>
<th>Bupivacaine (IA) 0.5% 10ml</th>
<th>Bupivacaine 0.5% 8ml (IA) + Dexamethasone 2ml (8mg)</th>
<th>Saline (IA) 10ml</th>
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<tbody>
<tr>
<td><strong>Analgesic consumption</strong></td>
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<tr>
<td>Pethidine 50 mg, IM*</td>
<td>8.40</td>
<td>1.5</td>
<td>20.100</td>
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<tr>
<td><strong>The average painless Time (min)</strong>**</td>
<td>310±30</td>
<td>574±41</td>
<td>0</td>
</tr>
</tbody>
</table>

* Analgesic requirement was significantly lower in dexamethasone group than other groups (P<0.05)

** The average painless time was significantly longer in dexamethasone group than other groups (P<0.05)

IA: Intra-articular, IM: Intra muscular

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### References

F. Heshmati, M.B. Zeinaly, Kh. Mohammadzadeh, A.R. Mahoori