Intra-articular morphine and/or bupivacaine after total knee replacement

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The postoperative analgesic effects of intra-articular injections of bupivacaine and/or morphine were examined prospectively in 437 patients who had total knee replacement for osteoarthritis. They were divided randomly into four groups. Group I received 10 mg of morphine (1 ml) and 9 ml of saline, group II received 10 ml of bupivacaine (2.5 mg/ml), group III received 10 ml of saline, and group IV received 10 mg of morphine (1 ml) and 9 ml of bupivacaine (2.5 mg/ml). All analgesics administered in the first 24 hours after operation were recorded. The patients rated their pain on the McGill-Melzack scale at 1, 6, 12 and 24 hours. No significant differences were found between any of the groups in the use of Demerol and/or Toradol in 24 hours, the length of stay in hospital or the pain rating at 1, 6, 12 or 24 hours. Patients in groups I and IV, whose injections included morphine, used significantly more morphine in the first 24 postoperative hours than did groups II or III.

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In 1991, Stein et al\(^1\) studied the analgesic effects of intra-articular injections of morphine after arthroscopic knee surgery. Their findings suggest that only small amounts are required to manage pain effectively. More recently, Badner et al\(^2\) noted that bupivacaine markedly reduced the need for postoperative analgesia and led to an increase in the range of flexion achieved after total knee replacement (TKR). We have therefore studied the analgesic effect of morphine and bupivacaine, both alone and in combination, on the control of pain after TKR.

Patients and Methods

We studied 437 consecutive patients (294 women and 143 men) who had had primary unilateral TKR for osteoarthritis and had no allergic reaction to morphine. Gastrointestinal reactions were accepted, but postoperatively, patients with these problems were given Demerol or Toradol.

The patients were randomised prospectively by computer into four groups. The mean age was 71.76 years (29 to 93, SD 8.31) (Table I). In group I there were 41 men and 68 women with a mean age of 69.5 years, in group II 36 men and 78 women of mean age 71.7 years, in group III 25 men and 72 women of mean age 72.9 years and in group IV 41 men and 76 women, with a mean age 72.3 years.

We used general anaesthesia in 357 patients and spinal anaesthesia in 80. All spinal anaesthetics used 3 ml (0.5%) of bupivacaine.

After skin closure, various combinations of analgesics were injected into the knee. Group I received 10 mg of morphine (1 ml) and 9 ml of saline, group II 10 ml of bupivacaine (2.5 mg/ml), group III 10 ml of saline, and group IV 10 mg of morphine (1 ml) and 9 ml of bupivacaine (2.5 mg/ml). The injections were given under double-blind conditions. The postoperative protocol was the same in all cases. No wound evacuation drains were used. Walking began on day one. On the second day, the knees were put through a range of movement. Patients were discharged between the fourth and sixth days.

We used the McGill-Melzack pain questionnaire,\(^3\) which rates no pain at 0 and severe pain at 5; patients assessed their pain at 1, 6, 12 and 24 hours postoperatively. As another indicator of pain, all analgesic drugs administered in the first 24 hours after surgery were recorded: these included Toradol, Demerol and morphine. Most patients used patient-controlled analgesia (PCA) so that they themselves could administer intravenous boluses as necessary. The PCA machine was put on to the lockout mode after two hours. It dispensed morphine unless there was a history of allergy, in which case Demerol was used.

The Mann-Whitney U test was used to compare two different groups, and the Kruskal-Wallis one-way analysis of variance on ranks to compare multiple groups.
Results

The Kruskal-Wallis one-way analysis of variance on ranks showed no significant difference between the consumption of Demerol (p = 0.3795) or Toradol (p = 0.3055) in the four groups in the first 24 hours after operation. The mean amounts of Demerol used were 171 mg in group I, 373 mg in group II, 304 mg in group III and 256 mg in group IV (Table I). The mean amounts of Toradol used were 87.2 mg in group I, 90.3 mg in group II, 102.3 mg in group III, and 88.7 mg in group IV.

As shown in Table I, there was no significant difference in the patients’ rating of their pain at 1 (p = 0.7553), 6 (p = 0.7463), 12 (p = 0.4901) and 24 hours (p = 0.2945) in the four groups, and no significant difference in the length of stay in hospital (p = 0.2945).

Comparison of the consumption of morphine in the four groups showed four differences. Patients in group I (morphine and saline) used significantly more morphine (p = 0.0076, mean 41.1 mg) than those in group II, who received only bupivacaine (mean 33.5 mg). Group I also used significantly more morphine (p = 0.0264) than patients in group III who received only saline (mean 3.47 mg). Group III used significantly less morphine (p = 0.0242, mean 34.7 mg) in 24 hours than patients in group IV who received morphine and bupivacaine (mean 40.3 mg). Finally, group II also used significantly less morphine (p = 0.0101) than group IV. Patients who had received morphine postoperatively continued to use more analgesic throughout the first 24 hours, irrespective of whatever else they received (Table I).

In the 357 patients who had TKR under general anaesthesia, there was no statistical difference in postoperative pain between the four groups (Table II) at 1 (p = 0.5867), 6 (p = 0.3026), 12 (p = 0.5138) and 24 hours (p = 0.4075). At 24 hours there was no significant difference in the use of Toradol (p = 0.1367) or Demerol (p = 0.6042). If morphine had been injected into the knee at skin closure, patients used more intravenous morphine at 24 hours (p = 0.0065). There was no difference in the amount of morphine used at 24 hours by patients in groups III and IV (p = 0.0899), groups II and III (p = 0.3154) and groups I and IV (p = 0.4821). There was, however, a difference between groups I and II (p = 0.0028), groups I and III (p = 0.0451), and groups II and IV (p = 0.0077).

A multivariate regression model, which made adjustments for factors such as age, gender and type of anaesthetic, was used to assess the effect of intra-articular injections of bupivacaine and/or morphine on the pain ratings of patients who had received spinal anaesthesia. No significant difference was found at 1 (p = 0.5474), 6 (p = 0.7561), 12 (p = 0.1173) and 24 (p = 0.6872) hours (Table III).

Discussion

Our findings were contrary to those of Stein et al. Patients whose injection at skin closure contained morphine used more morphine in the first 24 hours after surgery than those who had not been given morphine. Badner et al found that patients who had had TKR, and were given post-closure intra-articular injections of 30 ml of 0.5% bupivacaine with 1:200 000 epinephrine used less PCA narcotic. In our
groups II and IV, which were similar to those of Badner et al except that we used less bupivacaine (10 ml and 9 ml in groups II and IV, respectively), this drug appeared to have no significant effect, whether administered alone or with morphine. The only explanation which we can offer for these discrepancies is that the volume of the bolus injected was different.

Our results do not support the suggestion by Stein et al\(^1\) and Badner et al\(^2\) that morphine and/or bupivacaine injected intra-articularly at skin closure has a superior post-operative analgesic effect in primary TKR.

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References

