

Comparison of Intraarticular Bupivacaine With the Addition of Morphine or Fentanyl for Analgesia After Arthroscopic Surgery

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Summary: A randomized study on 30 patients undergoing knee arthroscopy was performed. Group I (n = 15) received 50 mg of 0.25% bupivacaine and 1 mg of morphine, and group II (n = 15) received 50 mg of 0.25% bupivacaine and 100 µg of fentanyl. The visual analogue scale was recorded at intervals of 1, 2, 3, 4, 6, 12, 24, and 48 hours after the operation. Supplementary analgesia requirements were also recorded. In group I, pain scores were lower than group II ($P < .05$) during the 1st, 2nd, 3rd, 12th, 24th, and 48th hours. The duration of analgesia on group I was significantly longer than group II. The combination of intraarticular morphine and bupivacaine has a longer analgesic duration and effect than a combination of fentanyl and bupivacaine. **Key Words:** Analgesics—Opioid—Fentanyl—Morphine—Local anesthetic—Bupivacaine—Postoperative pain.

Administration of local anesthetic drugs intraarticularly is very popular in arthroscopic surgery in that it provides postoperative pain relief and early discharge.¹⁻³ Even though there are many studies related to intraarticular injection of local anesthetics, there are very few studies related to intraarticular administration of opioids. Recent studies showed that opioids produce effective analgesia through activation of opioid receptors in peripheral tissue.⁴

In our study, patients received low doses of morphine and fentanyl in addition to local anesthetics.

MATERIALS AND METHODS

We performed a randomized study on 30 patients undergoing arthroscopic surgery of the knee joint in

the Department of Orthopaedic Surgery and Traumatology, İbn-i Sina Hospital, University of Ankara Faculty of Medicine (Table 1). In both groups, the same kind of operation was performed by the same surgeon under general anesthesia (Table 2). In both groups, agents were given 20 mL diluted solution of saline intra-articularly at the end of arthroscopic surgery by the orthopaedic surgeon. Group I (n = 15) received 50 mg of 0.25% bupivacaine and 1 mg of morphine (10 mL bupivacaine 0.5% solution, 10 mL normal saline, and 1 mg morphine). Group II (n = 15) received 50 mg of 0.25% bupivacaine and 100 µg of fentanyl (10 mL bupivacaine 0.5% solution, 10 mL normal saline, and 100 µg fentanyl). An observer blind to the agents injected recorded the visual analogue scale (VAS) at intervals of 1, 2, 3, 4, 6, 12, 24, and 48 hours after the operation. The blood pressure, heart rate, and respiratory rate were recorded. Postoperative pain was assessed at intervals by a VAS and requirements for supplementary analgesia were recorded.

The results are expressed as mean and standard error of mean (SEM) and analyzed using paired Student's *t*-test.

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TABLE 1. Details of Patients

	Group I (Morphine)	Group II (Fentanyl)
ASA*	I	I
Sex (M/F)	12/3	7/8
Age (yr)	34.2 + 16.3	31.0 + 10.4
Weight (kg)	68.9 + 12.3	68.0 + 9.7
Duration of operation (min)	25 + 5	25 + 5
Operative procedure	Arthroscopic surgery	Arthroscopic surgery

* ASA, American Society of Anesthesiologists Preoperative Classification System.

RESULTS

Patient characteristics are displayed in Table 1. Thirty patients of American Society of Anesthesiologists Preoperative Classification System grade I (a normal, healthy person other than surgical pathology, without systemic disease) were included in the study. There were no significant differences between the two groups with regard to age, sex, weight, and the duration of anesthesia ($P > .05$).

In group I, blood pressures were significantly decreased during the first 3 hours, whereas in group II there was a decrease that was not significant ($P < .05$) (Fig 1). Blood pressures and respiratory rates were stable in both groups. There were no significant differences between the groups and in the same group ($P > .05$) (Figs 2 and 3). Pain scores were significantly lower in the morphine group than in the fentanyl group during the first 3 hours ($P < .05$). At 12, 24, and 48 hours, pain scores were still higher in the fentanyl group and there were significant differences between the groups ($P < .05$) (Student's *t*-test) (Fig 4).

There were no significant differences in supplementary analgesic requirements between the groups. Only 3 patients in group II required 240 mg ketorolac totally, whereas there was no supplementary analgesic required in group I (Table 3).

TABLE 2. Details of the Arthroscopic Surgery

	Group I (Morphine)	Group II (Fentanyl)
Meniscectomy	6	6
Removal of foreign body	2	2
Chondroplasty	2	2
Synovial procedures	3	3
Debridement	2	2

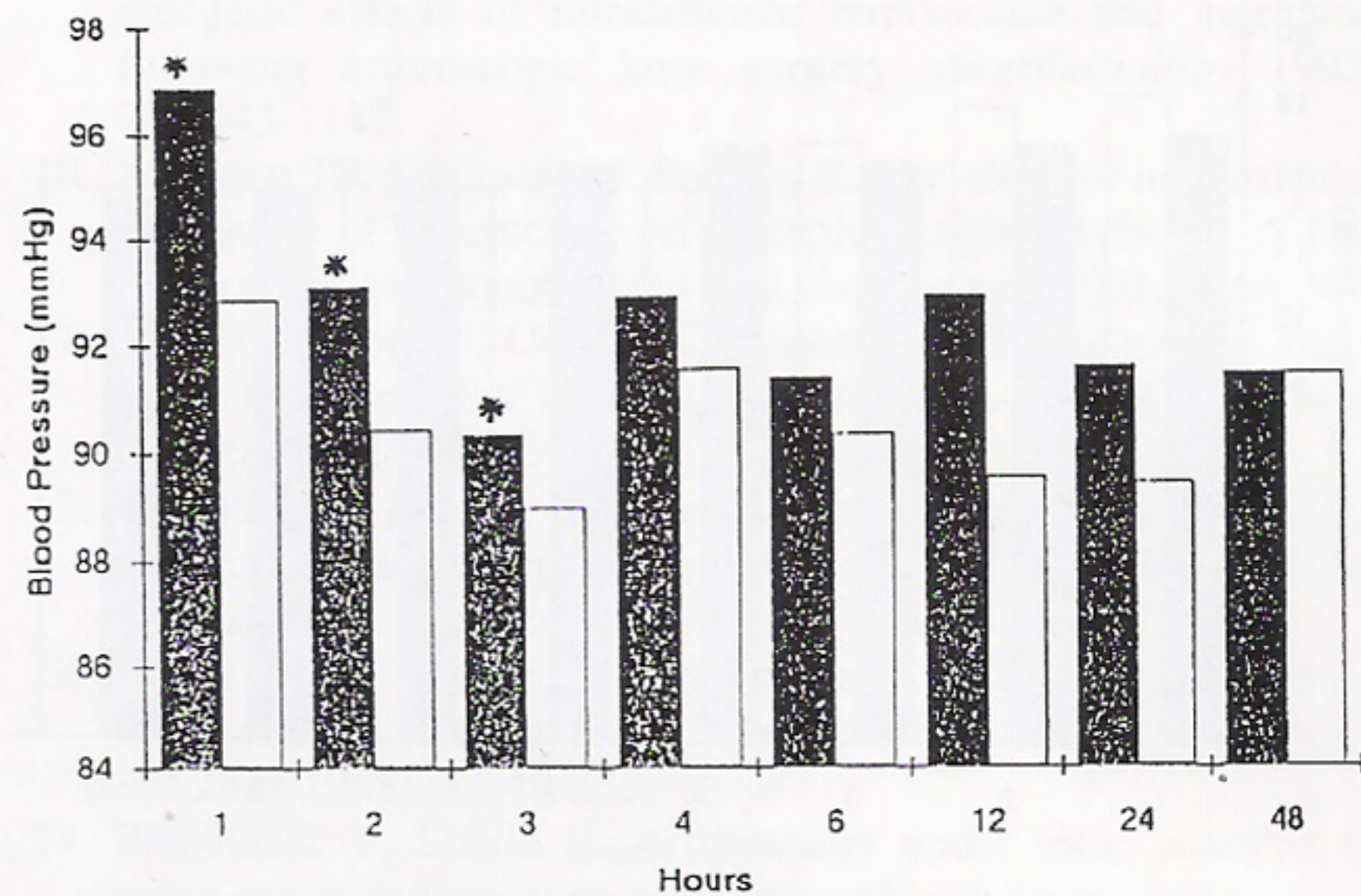


FIG 1. Mean arterial blood pressure of groups (* $P < .05$) (■) morphine, (□) fentanyl.

DISCUSSION

It is accepted that local anesthetics produce their effects on peripheral nerves. Local anesthetics are widely used in the blocking of intraarticular pain receptors. Different results were obtained from administration of opioids and local anesthetics for postoperative analgesia.

In our study, we compared intraarticular low dose morphine and bupivacaine with fentanyl and bupivacaine for analgesia after arthroscopic surgery.

In group II, pain scores and mean arterial blood pressures were lower postoperatively in the first 3 hours. Heart rates and respiratory rates were stable in both groups because of the slow intraarticular absorption and low liposolubility of morphine and relatively less blood circulation of the knee joint.⁵

Bupivacaine is a local anesthetic of the amide group

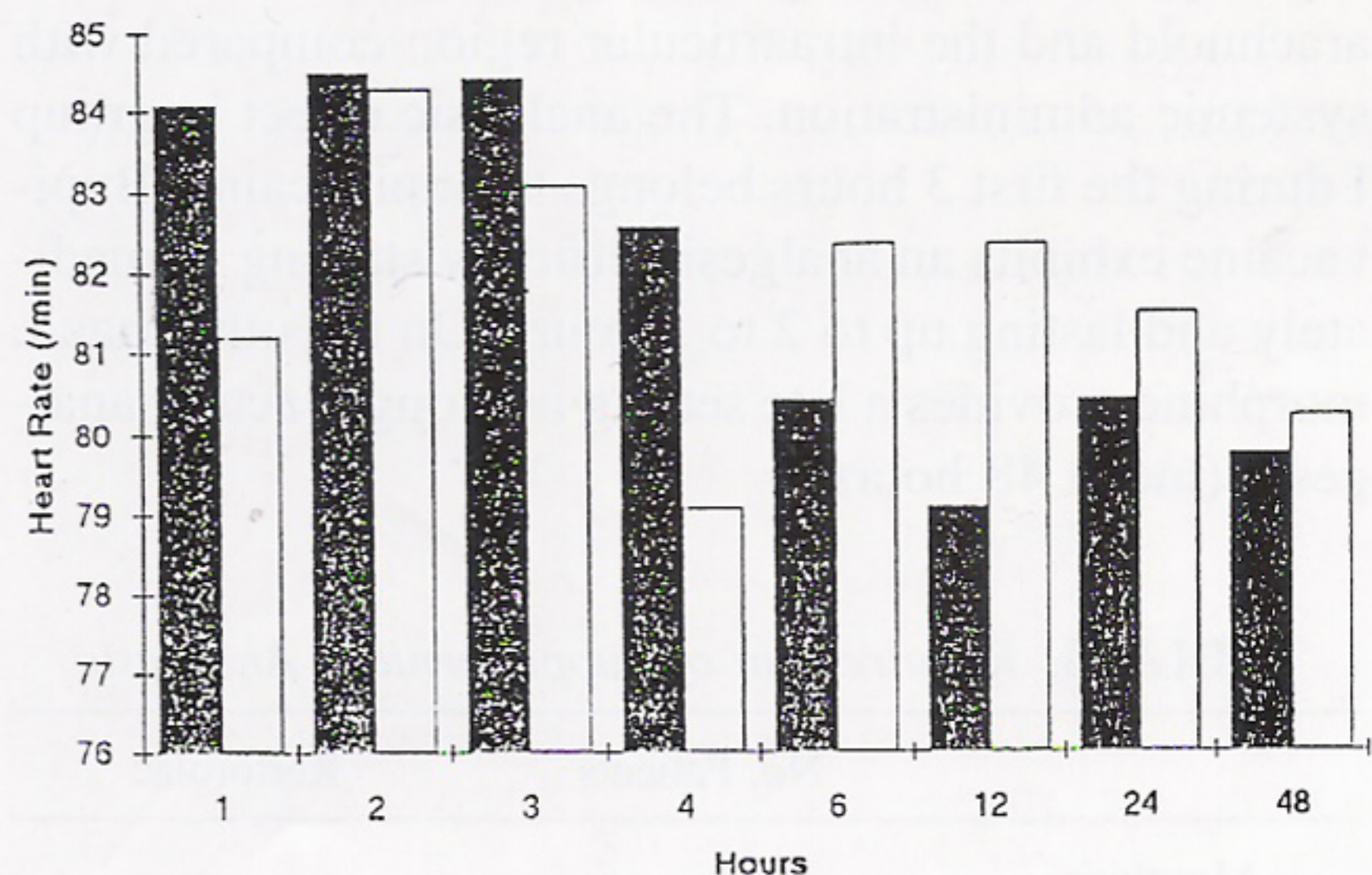


FIG 2. Mean heart rates of groups (■) morphine, (□) fentanyl.

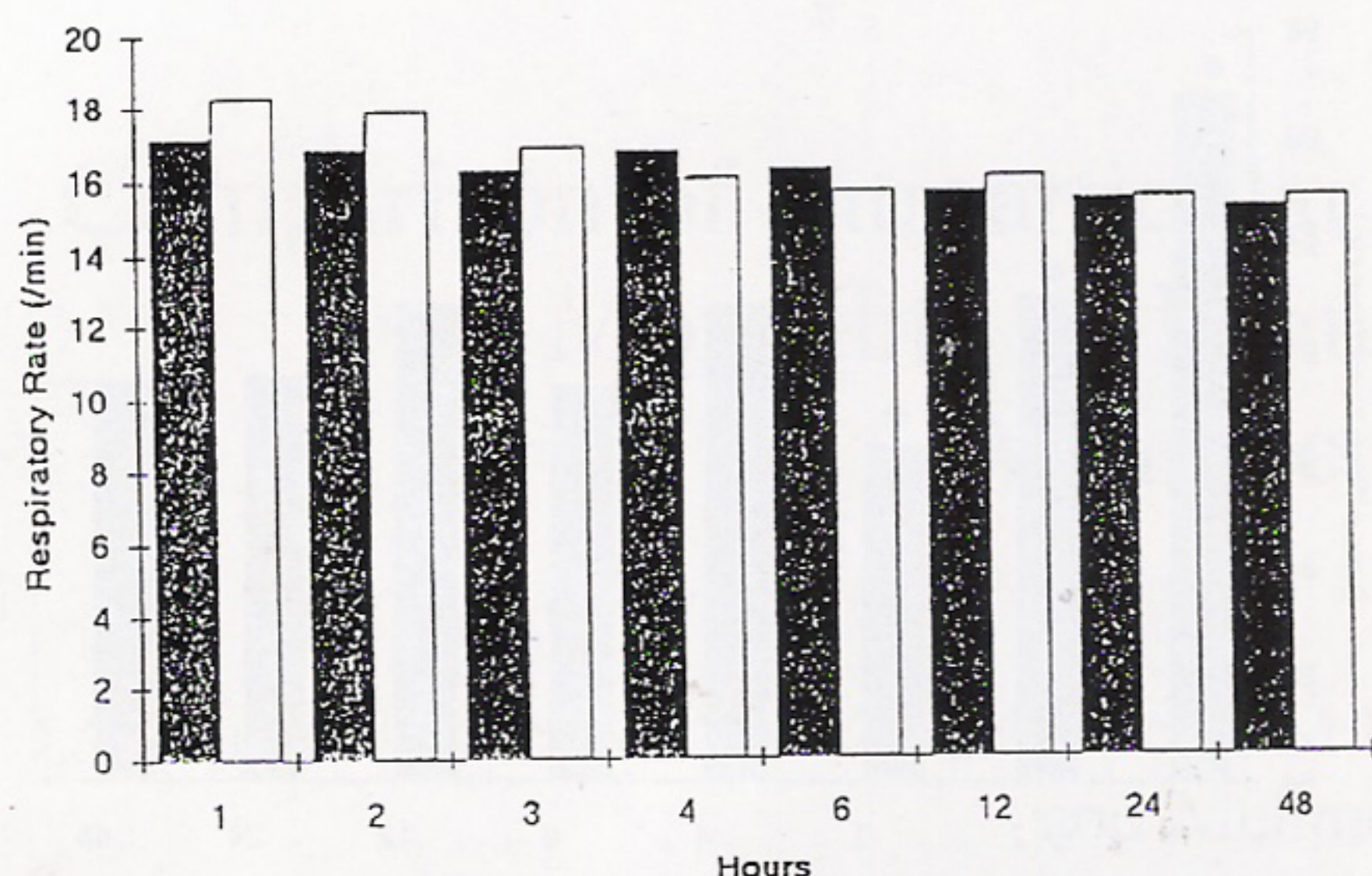


FIG 3. Mean respiratory rates of groups (■) morphine, (□) fentanyl.

with a long duration of action compared with other drugs in its class. It has a high liposolubility absorption, and rapid elimination from the articular area. It was shown that serum levels of bupivacaine remained well below toxic levels following injection of 100 mg into the knee joint, and bupivacaine does not appear to be harmful to articular cartilage.^{6,7}

Fentanyl also has high liposolubility similar to bupivacaine.

In our study, postoperative pain scores were lower in group I during the first 3 hours. The analgesic effect of morphine and bupivacaine were prolonged up to 48 hours after intraarticular injection. In group II, analgesic effect was observed without any systemic side effects in the first 3 hours. Afterwards its efficacy disappeared.

Opioid receptors are mostly located on the terminal end of the nerves and they are activated by inflammation. In this situation afferent ends of the nerves and leukocytes are the target sites.⁴

Morphine has a longer analgesic effect in the subarachnoid and the intraarticular region compared with systemic administration. The analgesic effect in group I during the first 3 hours belongs to bupivacaine. Bupivacaine exhibits an analgesic efficacy starting immediately and lasting up to 2 to 3 hours. On the other hand, morphine provides a late setting but longer acting analgesia (mean 48 hours).

TABLE 3. Requirement of Supplementary Analgesic

	No. Patients	Ketorolac
Morphine	—	—
Fentanyl	3	240 mg

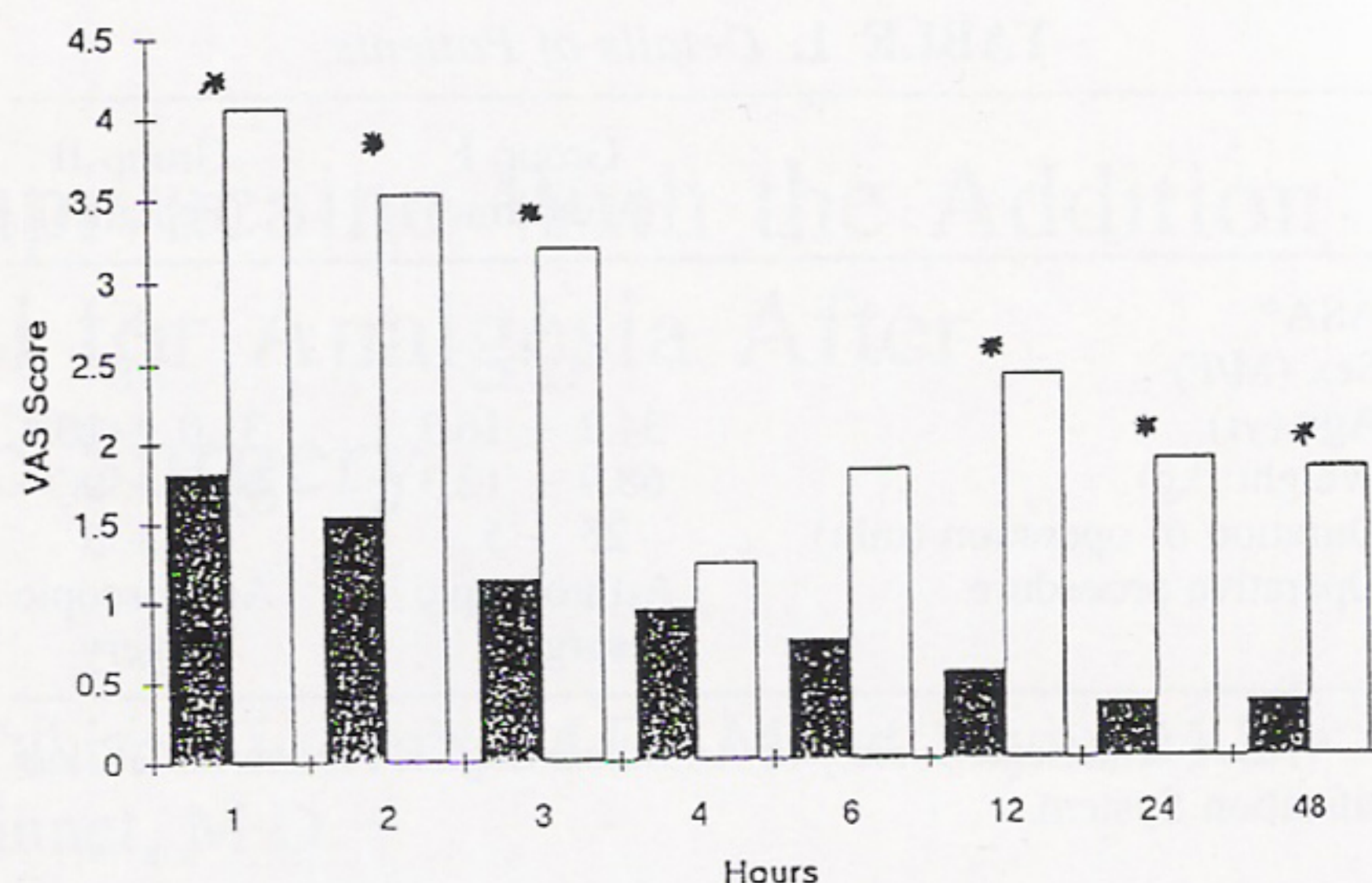


FIG 4. Pain scores of groups (* $P < .05$) (■) morphine, (□) fentanyl.

Some investigators suggested that bupivacaine has a longer duration of analgesic effect,⁸ whereas others reported that bupivacaine does not have enough analgesic efficacy.^{1,9,10} There are also reports suggesting that bupivacaine provides adequate analgesia to decrease the supplementary analgesic requirement.²

Combination of morphine and bupivacaine provided adequate analgesia during the whole study period. Joshi et al.¹¹ proved morphine to be effective, too. Postoperative analgesia provided with a low dose of morphine suggests that it has a local effect although there are some controversies.^{8,12}

There are also reports on the rapid absorption of prilocaine from the knee joint and high blood levels, but the short duration is regarded as a disadvantage.^{13,14}

When the supplementary analgesic requirements were evaluated, results were on behalf of the morphine group. In the fentanyl group, only 3 patients required intramuscular administration of ketorolac (240 mg). First doses were administered at the end of the first day and second doses on the following day. Their analgesic requirements were correlated with their pain scores.

CONCLUSION

A combination of intraarticular morphine and bupivacaine has a longer analgesic duration than a combination of fentanyl and bupivacaine. We suggest that morphine and bupivacaine is the best choice for the postoperative analgesia after arthroscopic surgery.

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