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Quality of postoperative analgesia in day-case operative knee arthroscopy: role of fentanyl added to intra-articular bupivacaine and antiinflammatory therapy

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Abstract

Adding opioids to intraarticular local anaesthetics is a common practice for postarthroscopy pain relief, but the results are controversial. We compared 60 patients randomized in two groups who following knee arthoscopy received intraarticular bupivacaine ($n = 29$), or fentanyl + bupivacaine ($n = 31$) for postoperative pain relief. All patients were on ibuprophen therapy, and care was taken to maintain local cold over the operated knee. The incidence of pain in the post anasthesia care unit (PACU) and postoperative pain was very low (13–17%) and not related to the administration of fentanyl, or whether the surgical procedure performed was a meniscectomy or chondroplasty. Postoperative pain was treated in the PACU with i.v. ketorolac, and at home with oral ibuprophen.

Keywords: Day case; Knee arthroscopy; Postarthroscopy pain relief

1. Introduction

Operative knee arthroscopy is currently done on a day-case basis with different types of anaesthesia. As a thigh tourniquet is not frequently used in our unit, the procedure can be safely done under infiltrative local anaesthesia of the knee cavity and through the ports used to introduce the instruments. As the anaesthetic is washed out during the operative procedure, an additional volume of a local anaesthetic solution, usualy 10 ml bupivacaine 0.5% with or without epinephrine, is left inside the knee cavity for postoperative analgesia. Morphine sulfate has been added to the local anaesthetic solution in order to improve analgesia but results of this practice have produced conflicting reports on its real utility [1–3]. Although morphine is a poor lipid soluble opioid it can be absorbed from any anatomical tissue, so results can be attributed either to its local or systemic effects [4].

In other forms of regional anaesthesia fentanyl has been reported to be sinergistic to the analgesic activity of bupivacaine, although through a different mechanism whereby opioid receptors play an important role, but no opioid receptors have been demonstrated to exist in the synovial membrane with standard histological methods. Recent developments in the immunohistochemical techniques have shown reactivity for neuropeptides [5]. The purpose of this study was to compare the postoperative analgesic effects of adding a more lipid soluble opioid, as fentanyl, to the local anaesthetic solution left inside the knee, versus plain bupivacaine 0.5%, in patients receiving antinflammatory oral therapy. Additionally, a potential difference in the incidence of pain was sought according to the type of surgical procedure performed, as chondroplasty is more invasive to the bone integrity than meniscectomy.

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Table 1
Patient data (mean ± S.D.)[a]

	Age	Weight (kg)	Chondroplasty (*n*)	Meniscectomy (*n*)
No Fent. ($n = 29$)	49.62 (± 15.2)	74.9 (± 12.3)	12	17
Fentanyl Intraartic. ($n = 31$)	49.94 (± 15.8)	77.6 (± 9.67)	17	14

[a] Differences not statistically significant.

2. Method

Sixty consenting adult patients, American Society of Anesthesiologists (ASA) classification I–II, undergoing operative knee arthroscopy for meniscectomy, chondroplasty and/or debridement were included in the study. Exclusion criteria were: extremely reduced intraarticular compliance, surgery for anterior cruciate ligament reconstruction, need to use a thigh tourniquet, body weight above 99 kg, age older than 80 years, diabetes, liver or kidney disfunction, allergy to the drugs used, psychiatric treatment, and the need for general anaesthesia or heavy sedation. All patients were operated on a day-care basis, and discharged from the hospital no later than 5 h after the end of the surgical procedure.

Patients were not premedicated, and upon arrival to the surgical area were prepared for a local infiltration of the knee cavity which was done by the anaesthesiologist, with 20 ml 0.25% bupivacaine with epinephrine plus 20 ml 1% lidocaine. The final epinephrine concentration in the solution was 1:400 000. Total volume was administered with an injection through an internal approach, 1–1.5 cm medial and superior to the angle of the knee bone. The surgeon infiltrated the skin over the points used to introduce his instruments inmediately before starting his procedure. Standard monitoring included ekg, automatic blood pressure recording, heart rate, and pulse oximetry. Intraoperative sedation was provided only if needed, with 1 mg midazolam i.v., titrating its effect as to avoid inducing hypnosis.

At the end of surgery patients were randomly asigned to receive either 10 ml bupivacaine 0.5% alone or combined with 2 μg/kg of fentanyl inside the knee cavity. They were moved to the post anaesthesia care unit, with a cryo-cuff, for observation for 1 h, and later transferred to the ward for no more than 5 h stay at the hospital. If patients complained of pain, either in the recovery room or the ward, they received i.v. ketorolac 30–60 mg. Before discharge from the hospital the patients were instructed to take oral ibuprophen 200 mg three times a day, and keep local intermitent cold over the operated knee for the following 72 h. If they should feel pain or severe discomfort at home, the indication was oral ketorolac 20 mg no more frequently than once every 6 h, and note the time for the first analgesic intake.

Results were analyzed with ANOVA and 2-way contingency table with Fisher's Exact Test, $P < 0.05$ being considered significant.

3. Results

As a result of randomization 29 patients received 10 ml intraarticular 0.5% bupivacaine (control group) and 31 received 8 ml 0.5% bupivacaine plus 100 μg fentanyl (fentanyl group). All patients were ASA status I or II. There was no difference between both groups in age or weight (Table 1). A total of 12 patients in the control group, and 17 patients in the fentanyl group underwent chondroplasty, a difference that was also non significant ($P = 0.217$).

Five patients complained of intraoperative pain, four of these in the chondroplasty group. The difference could not be attributed to the surgical procedure as in three of the complaining patients the etiology of pain was identified as due to overpressure in the irrigating system, and corrected simply by lowering the perfusion pressure. Besides, independently of the cause, Fisher's Exact Test yielded a P value $= 0.157$.

Tests for homogeneity showed no difference between the two groups regarding presence or absence of pain in the recovery room, as well as in the following 24 h. Treatment with i.v. ketorolac was successful in every case. The three patients that complained of pain in the recovery room had undergone chondroplasty ($P = 0.107$ vs. no chondroplasty), two out of 29 patients in the control group, and 1 out of 31 patients in the fentanyl group ($P = 0.475$).

Only nine patients needed analgesics in the first 24 h of the postoperative period (control group: 5; fentanyl group: 4, $P = 0.456$). The time taken for the first recorded need for analgesics had a wide variation among the cases, with a range between 2 and 24 h in the control group and 6 and 23 h in the fentanyl group. Mean time for analgesic requirement was also similar in both groups: 15.40 ± 16.88 s.d. (control) versus 14.25 ± 8.06 s.d. (fentanyl group), but patients with chondroplasty ($n = 5$) took the first dose in a mean time of 9.2 ± 4.44 h while those without chondroplasty had a mean time of 22 ± 17.26 h. The difference was not significant ($t_{3.3} = 1.45$, $P = 0.244$) due to the wide dis-

persion in the latter group. Additionaly, postoperative need for supplemental analgesics could not be related to either the occurrence of intraoperative pain or pain in the PACU.

4. Discussion

One of the advantages of the anaesthetic technique used, over epidural or general anesthesia, is that intraoperative pain due to overpressure in the irrigating system is not masked. That type of pain appears in a very short time when pressure inside the knee cavity increases more rapidly than fluid can escape from the system drainage, so it pushes cephalad into the sinovium cavity behind the anterior muscles of the thigh. In theory the fluid does not traverse soft tissues surrounding the knee cavity but simply pushes them out like a hernia, because the exquisite pain which is verbalized as 'deep behind the quadriceps', dissappears in no more than a few minutes after lowering the pressure level in the system. Debruyne et al. reported that pressures higher than 100 mmHg should not be used, to prevent the escape of the solution into the soft tissue of the leg [4].

Pain in the recovery room, although present only in the patients that had undergone chondroplasty, could not be related to this procedure or the administration of fentanyl in the knee cavity. Its incidence was extremely low, as was postoperative need for supplemental analgesics in the following 24 h period.

Ruwe et al. concluded that the most significant predictor of postoperative pain was preoperative level of discomfort [1]. Meniscectomies are usually performed once the acute phase of the original problem has subsided. In our practice most of the patients undergoing arthroscopy who had preoperative discomfort required chondroplasty due to several degrees of arthrosis with reductions in intraarticular compliance. We were unable to find a significant correlation as Ruwe did.

Intraarticular bupivacaine is a common practice for postarthroscopy pain and the addition of morphine has been controversial [1–3,6–8]. Some reports conclude that morphine given without the local anaesthetic is similar to placebo [9] and that bupivacaine is the only drug with a certain effect in the mixture. Other authors communicate exactly the opposite claiming that bupivacaine is much less effective than morphine [10], and some even neglect the effectiveness of both drugs [11].

According to our results the higher lipid solubility and potency of fentanyl do not appear to offer any advantage to the pain relief offered by intraarticular bupivacaine in patients treated with oral ibuprophen and the local physical effect of cold. Some pharmacological effects of morphine have been reported in joints, supporting the hypothesis that it acts as a potential suppressor of the substance P mediated cytokine cascade and the periphereal leukocyte activity [12] after knee surgery.

Although no opioid receptors have been found in normal knee tissues, it has been long known that they can play a functional role in antinociception in inflamed tissue [13]. In animal experiments, Nagasaka et al. were able to describe a peripheral activity of opioids, blocking autonomic responses to pain evoked by compression of the artificially inflamed knee joint of the rat [14]. The rationale for avoiding or diminishing inflamation with non-steroidal antiinflammatory drugs (NSAID) is then evident, although this therapy must be applied with care in osteoarthritic patients [15]. Some authors have injected non-steroidal antiinflammatory drugs inside the knee cavity. Tenoxicam, a water soluble NSAID, has been shown to be devoid of potential general or local side effects when used intraarticularly and similar quantitatively to the effects of bupivacaine although longer lasting than the local anaesthetic [16].

Differing reports offered in the literature may be related to whether an NSAID was utilized postoperatively for its antiinflammatory and analgesic properties. The potential role of the antiinflammatory properties of the local anaesthetic must also be considered. Our results suggest that if antiinflammatory therapy is effective, opioids will lack enough substrate of peripheral receptors upon which to exert their pharmacological activity. Hence no significant differences will be found between patients who received or did not receive intraarticular opioids.

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