Combined intra-articular glucocorticoid, bupivacaine and morphine reduces pain and convalescence after diagnostic knee arthroscopy

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ABSTRACT – We studied the effect of intra-articular saline vs. bupivacaine + morphine or bupivacaine + morphine + methylprednisolone after diagnostic knee arthroscopy.

In a double-blind randomized study, 60 patients undergoing diagnostic knee arthroscopy without a therapeutic procedure were allocated to groups receiving intra-articular saline, intra-articular bupivacaine 150 mg + morphine 4 mg or the same dose of bupivacaine + morphine + intra-articular methylprednisolone 40 mg at the end of arthroscopy during general anesthesia. All patients were instructed to resume normal activities immediately after the procedure. Pain during movement and walking, leg muscle force and joint effusion, use of crutches and duration of sick leave were assessed.

A combination of bupivacaine and morphine reduced pain, duration of immobilization and of convalescence. The addition of methylprednisolone further reduced pain, use of more analgesics, joint swelling and convalescence.

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To reduce pain after arthroscopy NSAIDs (Rasmussen et al. 1993), intra-articular bupivacaine or intra-articular morphine (Kalso et al. 1997), and intra-articular glucocorticoid injections (Rasmussen et al. 1998, Wang et al. 1998, Rasmussen and Kehlet 2000) have been used. Intra-articular glucocorticoid may improve pain relief and convalescence after meniscectomy (Rasmussen et al. 1998, Wang et al. 1998, Rasmussen and Kehlet 2000), but there are no data regarding diagnostic arthroscopy.

We studied the effect of intra-articular methylprednisolone on pain, inflammatory response and rehabilitation after diagnostic knee arthroscopy as compared to placebo and intra-articular morphine and bupivacaine.

Patients and methods

60 patients subjected to diagnostic arthroscopy were enrolled in the study after informed consent. Exclusion criteria were: age < 18 or > 65 years, active peptic ulcer, hypersensitivity to NSAID, treatment with any anti-inflammatory drug or pregnancy, breast-feeding or intention to become pregnant. The patients selected were given 550 mg naproxen sodium twice a day for 10 days, starting on the evening before operation. Outpatient knee surgery was performed under general anesthesia with propofol and alfentanil, without a tourniquet. After the procedure, a 22-gauge needle was placed intra-articularly. The surgeon, who was blinded to the type of treatment, administered the drugs investigated, which were randomly allocated (envelope method) by an operating room nurse to group S: 40 mL 0.9% saline, group B+M: 30 mL bupivacaine 5 mg/mL + 10 mL morphine 0.4 mg/mL or group B+M+MP: 30 mL bupivacaine 5 mg/mL + 10 mL morphine 0.4 mg/mL + 1 mL 40 mg/mL methylprednisolone acetate.

Pain assessments were made 3, 6, 12 and 24 hours postoperatively. During the following days, the patient recorded the average intensity of pain at the end of each day on a visual analog scale

Patient data and observations

	S	B+M	B+M+MP
Sex, M/F	11/9	13/7	11/9
Age, mean, years	32	26	29
range	21–54	19–53	18–52
Normal	7	8	7
Osteoarthrosis	5	7	6
Chondromalacia patellae	3	2	2
Cartilage lesion	2		2
Osteochondritis	1	2	1
Anterior cruciate ligament rupture	2	1	2
Duration of operation			
mean, minutes	20	25	20
range	10–45	15–45	15–45

with flexion at 90 degrees, during stair lift and walking up and downstairs. Assessments included the number of hours of walking, use of crutches and paracetamol, time to becoming pain-free and return to usual work. All patients were allowed to resume their normal activities as soon as possible, without restrictions. Before and on the 10th day after surgery, clinical assessment of synovial effusion (yes or no), isometric quadriceps strength at 30° of flexion and range of motion were assessed.

The study was approved by the Local Ethics Committee and was in accordance with the Declaration of Helsinki. Calculation of sample size was based on the primary outcome measures of pain (visual analog scale) and return to work. It was calculated for observations on the interval scale. Type 1 and 2 errors were both set at 5%. Estimated standard deviation on the visual analog scale was set at 20. The smallest difference between the means not to be overlooked was set at 25. The number of patients in each group was calculated at 16. Expecting 80% to complete the study, a total of 60 patients were needed. Results are described with median and ranges, and analyzed using chi-square, Mann-Whitney, Wilcoxon and summary measures to analyze serial measurements when appropriate. $P < 0.05$ was considered significant.

Results

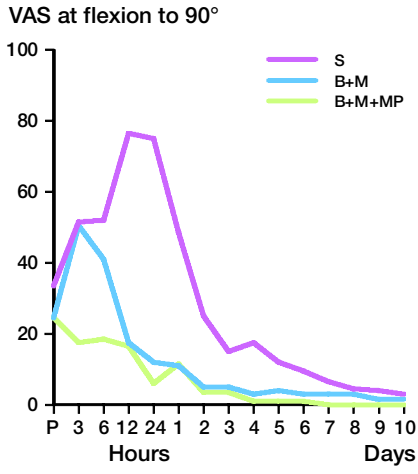
All 60 patients completed the study. Patient demographics were similar in the three groups (Table). No patient developed a postoperative infection.

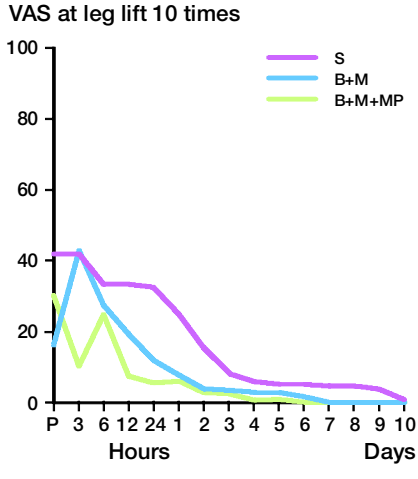
Pain scores during leg lift, flexion to 90 degrees and walking up and downstairs were significantly lower in the B+M+MP group than in the two other groups ($p = 0.0001$ and $p = 0.006$; $p = 0.001$ and $p = 0.002$; $p = 0.0001$ and $p = 0.008$) and between the B+M and the saline group ($p = 0.003$; $p = 0.003$; $p = 0.008$) (Figure 1). The total use of paracetamol 500 mg tablets was less in the B+M+MP group than in the other two groups (48 (B+M+MP), 112 (B+M), and 220 (S)) ($p = 0.002$), the difference between the S and B+M groups was also significant ($p = 0.003$). The use of crutches was briefer, the number of days before they became pain-free and returned to work were all less in the B+M+MP group than in the other two groups, but recovery was also hastened in the B+M group than in the S group (Figure 2). Postoperative recovery of quadriceps muscle strength measured on the 10th day was improved in the B+M+MP group (+2 kg) versus the B+M group (+0 kg) and the S group (–3 kg) ($p = 0.004$). On day 10, joint effusion was found in 13, 5 and 3 patients in groups S, B+M and B+M+MP, respectively ($p = 0.002$).

Discussion

The use of intra-articular morphine and bupivacaine at the end of a diagnostic arthroplasty had a clinically advantages analgesic effect extending into the late postoperative period and convalescence. It also resulted in less need for the use of crutches, shorter duration of sick leave and the patients could manage stairs better. The reason why our results were better than in other studies which found little, if any, effect is unclear, but we used a relatively larger dose of bupivacaine (150 mg) than the usual one of about 75–100 mg (Kalso et al. 1997). We also included a sufficient number of patients (n 60) who underwent a well-defined non-therapeutic diagnostic arthroscopy.

However, the main finding of our study was a further reduction of pain and functional impairment including the duration of convalescence (sick leave) by also giving intra-articular methylprednisolone acetate 40 mg. The mechanism was probably anti-inflammatory, since swelling was also reduced.





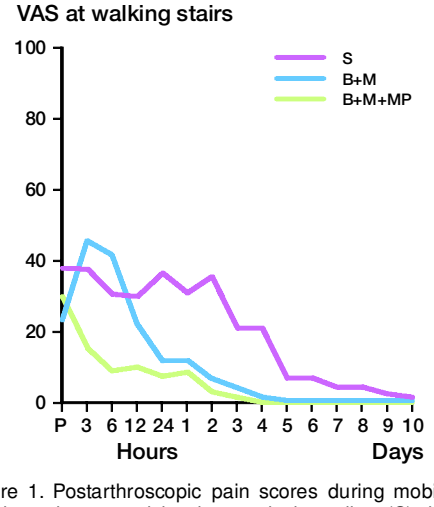
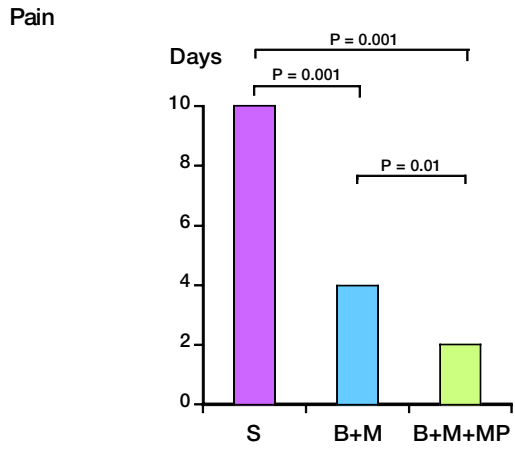
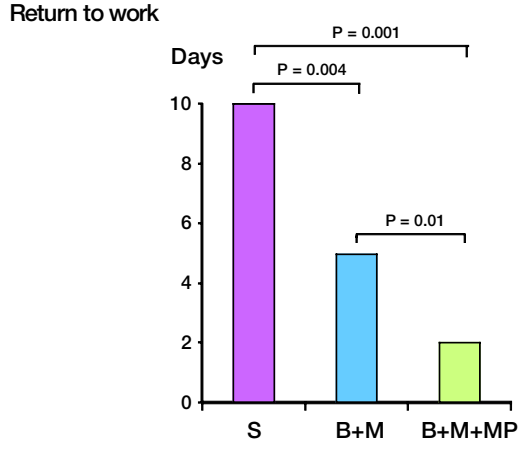


Figure 1. Postarthroscopic pain scores during mobilization in patients receiving intra-articular saline (S), intra-articular bupivacaine + morphine (B+M) or intra-articular bupivacaine + morphine + methylprednisolone (B+M+MP) (median values). P = preoperatively.





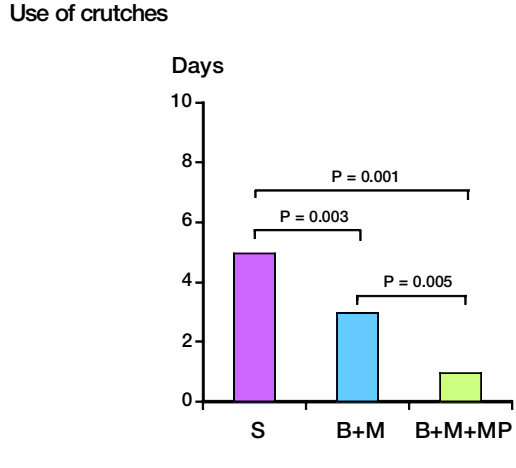


Figure 2. Time to becoming pain-free (top), returning to work (middle) and using crutches (bottom) after diagnostic arthroscopy with intra-articular saline (S), bupivacaine + morphine (B+M) or bupivacaine + morphine + methylprednisolone (B+M+MP) (median values).

Obviously, the potential of intra-articular glucocorticoid to shorten convalescence must be weighed against the risk of complications. The reduction of the inflammatory response may theoretically alter wound healing, although no impairment in subcutaneous collagen synthesis has been found in abdominal procedures (Schulze et al. 1997). However, there is no clinically relevant wound to heal after diagnostic arthroscopy and the inflammatory response may in this type of operation be considered as an unexpected response. Another potential complication in the use of intra-articular glucocorticoid administration is infection which, however, in various rheumatic disorders is negligible (< 1:20,000) after a single dose of glucocorticoid (Gray et al. 1981). Similarly, the incidence of septic arthritis after intra-articular glucocorticoid treatment was less than 0.2% in over 1500 knees (Montgomery and Campbell 1989). Moreover, no side effects have been seen after a single dose of glucocorticoid in other surgical procedures (Schulze et al. 1992, 1997).

Following therapeutic arthroscopic knee surgery, the combined use of intra-articular local anesthetic, morphine and methylprednisolone, is rational and effective in reducing pain and the inflammatory response, and it shortens convalescence after arthroscopic meniscectomy (Rasmussen et al. 1998, Wang et al. 1998, Rasmussen and Kehlet 2000). The use of systemic administration of glucocorticoid may also reduce the inflammatory response and pain after dental surgery (Skjelbred and Løkken 1982, Baxendale et al. 1993), abdominal procedures (Schulze et al. 1992, 1997), anterior cruciate ligament repair (Vargas and Ross 1989) and knee arthroscopic procedures (Highgenboten et al. 1993).

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