

Intra-articular glucocorticoid, bupivacaine and morphine reduces pain, inflammatory response and convalescence after arthroscopic meniscectomy

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Abstract

Convalescence after arthroscopic meniscectomy is dependent on pain and the inflammatory response. The aim of the study was therefore to investigate the effect of intra-articular bupivacaine + morphine + methylprednisolone versus bupivacaine + morphine or saline on post-meniscectomy pain, mobilisation and convalescence. In a double-blind randomized study 60 patients undergoing arthroscopic meniscectomy were allocated to intra-articular saline, intra-articular bupivacaine 150 mg + morphine 4 mg or the same dose of bupivacaine + morphine + intra-articular methylprednisolone 40 mg. All patients were instructed to resume normal activities immediately after operation. Pain during movement and walking, leg muscle force and joint effusion, use of crutches and duration of sick leave were assessed. Combined bupivacaine and morphine significantly reduced pain, time of immobilisation and duration of convalescence. Addition of methylprednisolone further reduced pain, use of additional analgesics, joint swelling and convalescence, improved muscle function and prevented the inflammatory response (acute phase protein) ($P < 0.05$). A multimodal analgesic and anti-inflammatory treatment may enhance post-arthroscopic convalescence, which depends on the trauma induced inflammatory response and pain. © 1998 International Association for the Study of Pain. Published by Elsevier Science B.V.

Keywords: Arthroscopy; Knee; Glucocorticoid; Rehabilitation; Pain

1. Introduction

Arthroscopic meniscectomy is currently performed with minimal complications, but pain and swelling may delay rehabilitation with return to work after 1–2 weeks and performance of usual physical activities within 2–4 weeks (Durand et al., 1991; St.-Pierre, 1995). Efforts have therefore been made to reduce post-meniscectomy pain with NSAIDs (Rasmussen et al., 1993), intra-articular bupivacaine or intra-articular morphine (Kalso et al., 1997), all of which may reduce, but not eliminate, pain, the inflammatory response and convalescence.

The use of systemic administration of glucocorticoid may reduce the inflammatory response and pain after dental

surgery (Skjelbred and Løkken, 1982; Baxendale et al., 1993) and abdominal procedures (Schulze et al., 1992; Schulze et al., 1997). Local glucocorticoid injection has been used for decades in various rheumatic disorders with documented reduced inflammation and pain (Gray et al., 1981), but no information is available on the use of intra-articular glucocorticoid following arthroscopic procedures.

The aim of this prospective double-blind randomized study was to assess the additional effect of intra-articular methylprednisolone on pain, inflammatory response and rehabilitation after arthroscopic meniscectomy compared with placebo and intra-articular morphine and bupivacaine.

2. Patients and methods

All patients admitted for diagnostic or therapeutic arthro-

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Table 1

Demographic data in patients undergoing arthroscopic meniscectomy and intra-articular saline (S), bupivacaine and morphine (B + M) or bupivacaine, morphine and methylprednisolone (B + M + MP)

| | S | B + M | B + M + MP |
|-------------------------------------|------------|------------|------------|
| Sex (male/female) | 12/8 | 11/9 | 15/5 |
| Median age (range) | 40 (18–61) | 40 (18–55) | 39 (18–55) |
| Medial meniscal lesion | 17 | 16 | 17 |
| Lateral meniscal lesion | 3 | 4 | 3 |
| Longitudinal lesion | 16 | 17 | 18 |
| Radial lesion | 4 | 3 | 2 |
| Median operation time (min) (range) | 30 (15–60) | 30 (15–75) | 30 (15–70) |

scopy were, after informed consent, enrolled in the study, with the purpose of investigating 60 patients undergoing arthroscopic meniscectomy for an oblique or bucket handle meniscal tear. Altogether, 141 patients were enrolled, where other operative procedures were performed in 54 patients and a diagnostic procedure only in 27 patients. Exclusion criteria were age <18 or >65 years, active peptic ulceration, hypersensitivity to NSAID, treatment with any anti-inflammatory drug or pregnancy, breast-feeding or intention to become pregnant. The selected patients were given 550 mg naproxen sodium twice a day for 10 days, starting the evening before operation. Operative outpatient knee surgery was performed under general anaesthesia with propofol and alfentanil, without a tourniquet. The central approach through the patella ligament was used with anteromedial or anterolateral portal access when necessary. Only large radial and longitudinal lesions were included. Following the completion of the procedure a 22 gauge needle was placed intra-articularly. The surgeon who was blinded to type of treatment administered the investigatory drugs, 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 (Depomedrol®).

On the day of operation pain assessments were made 3, 6, 12 and 24 h post-operatively. During the following days the patient registered the average intensity of pain at the end of each day on a visual analogue scale at flexion to 90°, during leg lift and during stair walking. Assessments included number of hours of walking activity, use of crutches and acetaminophen, time to being pain free and return to usual work. All patients were instructed to resume their normal activities as soon as possible, without restrictions. Blood samples were taken before and 10 days after the operation and analysed for orosomucoid. Before, and at ten days post-operatively, clinical assessment of synovial effusion (yes or no), isometric quadriceps strength at 30° 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.

Results are described with median and ranges, and analyzed using χ^2 , Mann–Whitney, Wilcoxon and analysis of variance test when appropriate. $P < 0.05$ was considered significant.

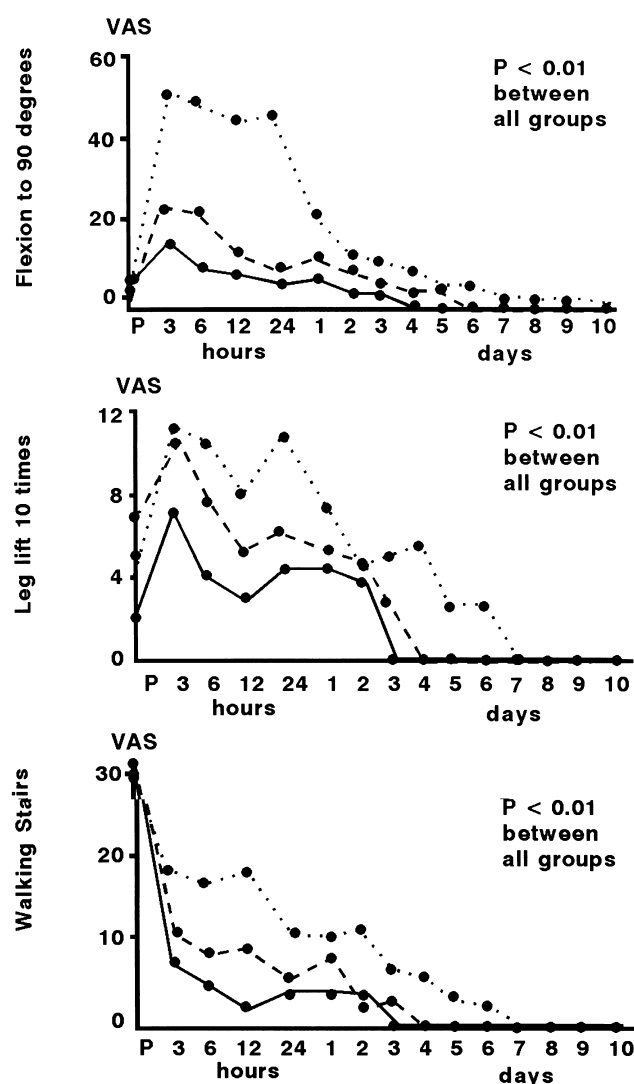
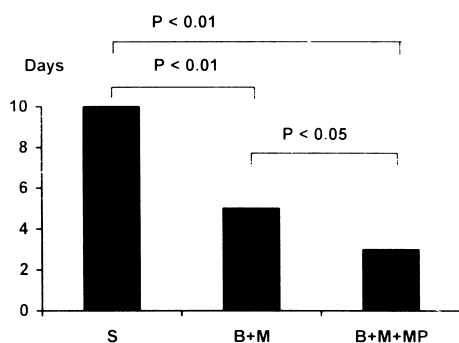
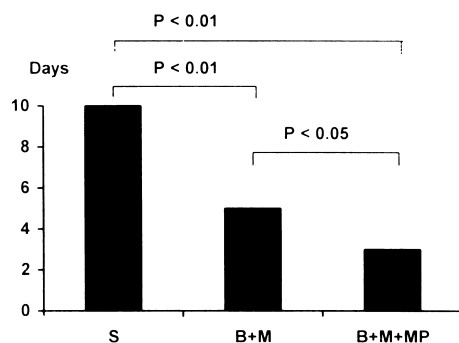


Fig. 1. Post-arthroscopic meniscectomy pain scores during mobilization in patients receiving intra-articular saline ●—●, intra-articular bupivacaine + morphine ●-● or intra-articular bupivacaine + morphine + methylprednisolone ●—● (median values). P = pre-operatively.

Pain.



Return to work.



Use of crutches.

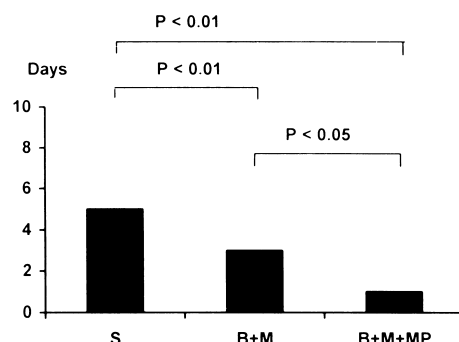


Fig. 2. Time to being pain free, return to work and use of crutches following arthroscopic meniscectomy with intra-articular saline (S), bupivacaine + morphine (B + M) or bupivacaine + morphine + methylprednisolone (B + M + MP) (median values).

3. Results

Patient demographics were similar in the three groups (Table 1). All 60 patients completed the study. Pain scores during leg lift, flexion to 90° and walking stairs were significantly less in the B + M + MP group than the two other groups ($P < 0.01$) and between the B + M and the saline group ($P < 0.01$) (Fig. 1). Total use of acetaminophen 500 mg tablets was significantly less in the B + M + MP group compared with the other two groups (25 (B + M + MP), 48 (B + M), and 108 (S)) ($P < 0.01$), the difference between the S and B + M group also being significant ($P < 0.01$). The number of days using crutches until being pain free and returning to work were all reduced in the B + M + MP group compared with the two other groups ($P < 0.05$),

but recovery was also enhanced in the B + M group compared with the S group ($P < 0.05$) (Fig. 2). Post-operative recovery of muscular quadriceps strength was significantly improved in the B + M + MP group (+6 kg) versus the B + M group (+1 kg) and the S group (−2 kg) ($P < 0.05$). At day 10, joint effusion was found in 11, seven and three patients in groups S, B + M and B + M + MP, respectively. Differences were significant only between the S and B + M + MP group ($P < 0.05$). Plasma orosomucoid increased ($P < 0.05$) in the placebo and B + M group, but not in the B + M + MP group, and the post-operative plasma orosomucoid concentrations were significantly lower in the B + M + MP group than the other two groups (Fig. 3). No patient had wound or joint infection.

4. Discussion

Patients recover more rapidly after arthroscopic surgery than after open meniscectomy because of a reduced trauma with less pain and inflammation. However, a certain amount of pain and inflammatory response (joint swelling) may occur even in arthroscopic surgery and thereby delay rehabilitation. Thus, following arthroscopic meniscectomy, patients are usually able to walk without support within 3–4 days, return to work after 1 to 2 weeks, resume athletic training by 2–4 weeks and return to competition in 3–4 weeks (Durand et al., 1991; St-Pierre, 1995). Therefore, in relation to the minor trauma of arthroscopy and meniscectomy, the convalescence period may seem relatively long.

Intra-articular local anaesthetics are often used in the management and prevention of early pain after arthroscopic knee surgery. However, the effect is usually shortlasting, and does not influence convalescence significantly. Recently, intra-articular morphine has been used, but a sys-

Plasma-orosomucoid before and after arthroscopic meniscectomy.

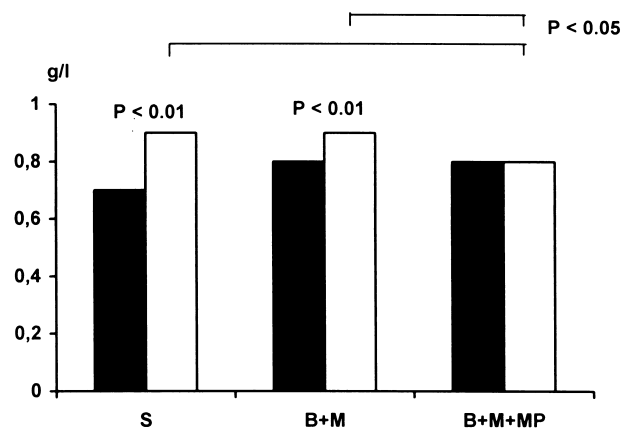


Fig. 3. Changes in plasma orosomucoid after arthroscopic meniscectomy with intra-articular saline (S), bupivacaine + morphine (B + M) or bupivacaine + morphine + methylprednisolone (B + M + MP) (median values).

temic review of the literature showed inconsistent analgesic effects, although several studies showed favourable effects and, occasionally, pain relief up to 24 h (Kalso et al., 1997). Due to the inconsistent results and inadequate design in many studies, final conclusions are hindered, and the effects of intra-articular morphine on all-over convalescence remain to be evaluated. The combination of intra-articular morphine and bupivacaine may enhance pain relief within the first 24 h (Kalso et al., 1997), but again with inconsistent design and results, and without conclusive effects on convalescence. In our study, in a well-defined surgical population, combined intra-articular morphine and bupivacaine showed a clinically relevant analgesic effect extending into the late post-operative period as well as improved convalescence with shortened need for crutches, shorter duration of sick leave and enhanced ability for stair walking. The explanation of our positive findings compared with other studies with smaller or no effects is unclear, except that we used a relatively large dose of local anaesthetic (150 mg) compared with a usual dose of about 75–100 mg (Kalso et al., 1997), and because we included a sufficient number of patients (60) and with well-defined surgical procedure.

However, the main finding of our study was a further reduction of pain and functional impairment including the duration of convalescence (sick leave) by addition of intra-articular methylprednisolone acetate 40 mg. The mechanism was probably anti-inflammatory, since swelling and the acute phase protein response (plasma orosomucoid) was also reduced or eliminated. Previous studies have shown glucocorticoids to reduce bradykinin in inflamed tissue (Hargreaves and Costello, 1990), but, in addition, there may be a direct inhibitory effect on transmission in nociceptive C-fibres (Johansson et al., 1990). Our findings are similar to those in various rheumatic disorders where local glucocorticoid injection may reduce inflammation and pain (Gray et al., 1981). Recent data from other surgical procedures have also demonstrated a pre-operative single dose glucocorticoid to reduce the hyperthermic, inflammatory (IL-6) and pain responses to abdominal procedures (Schulze et al., 1992; Schulze et al., 1997), and pain and swelling in dental procedures (Skjelbred and Løkken, 1982; Baxendale et al., 1993).

Obviously, the potential of intra-articular glucocorticoid to enhance 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 demonstrated in abdominal procedures (Schulze et al., 1997). However, there is no clinically relevant wound to heal following arthroscopic meniscectomy and the inflammatory response may, in this type of operation, be considered as an unwarranted response. Another potential complication of intra-articular glucocorticoid administra-

tion is infection which, however, in various rheumatic disorders is negligible (<1:20 000) following single dose administration (Gray et al., 1981). Also, no side effects have been observed following single dose administration of glucocorticoid in other surgical procedures (Schulze et al., 1992; Schulze et al., 1997).

In summary, the combined use of intra-articular local anaesthetic, morphine and methylprednisolone may therefore be rational and effective in reducing pain and the inflammatory response, and in enhance convalescence following arthroscopic meniscectomy. Further large-scale randomized studies are needed to assess the safety of this regimen, as well as this the need for simultaneous treatment with local anaesthetic and morphine should be explored.

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