The efficacy of intra-articular bupivacaine for relief of pain following arthroscopy of the ankle

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The intra-articular injection of local anaesthetic is frequently used for pain relief after arthroscopy. There is, however, no published evidence of the analgesic effect of bupivacaine in the ankle. In a randomised, double-blind study, 35 patients undergoing arthroscopy of the ankle were allocated to receive intra-articular saline or bupivacaine. Pain was assessed using pain scores and additional analgesic requirements. Intra-articular bupivacaine had a significant analgesic effect in the immediate post-operative period, reducing pain scores and the need for additional analgesics.

We recommend the use of intra-articular bupivacaine for post-operative analgesia in ankle surgery.

Arthroscopy of the ankle is performed routinely for diagnostic and therapeutic purposes.¹ The procedure is commonly carried out as a day case and effective analgesia is essential both immediately after operation and following discharge from hospital.²

Local anaesthetic is frequently injected intra-articularly and around the sites of the portals at the end of arthroscopic procedures to provide analgesia. Studies of intra-articular analgesia following arthroscopy of the knee have demonstrated that bupivacaine is both safe and effective.³⁻⁵ Other drugs have been used via this route, including opioids, but the results have been equivocal.^{6,7}

Only one previous study has assessed the use of intra-articular drugs for arthroscopy of the ankle. Rasmussen and Kehlet⁸ compared the use of a combination of bupivacaine, morphine and methylprednisolone with a placebo (saline) and found a reduction in pain and impairment of function. However, this combination has raised concerns with regard to infection owing to the inclusion of steroids, with this study describing one case of septic arthritis in the group.⁸ It is not possible to determine which of the drugs used in the combination provided effective analgesia.

Although studies of post-operative analgesia in arthroscopy of the knee have demonstrated that intra-articular bupivacaine is safe and effective, this has not been proven for arthroscopy of the ankle.³

Patients and Methods

We carried out a prospective, randomised, double-blind clinical trial at a single centre to

assess the analgesic effect of intra-articular bupivacaine on post-operative pain following arthroscopy of the ankle as a day case. Each patient undergoing the procedure was randomly assigned to receive either intra-articular bupivacaine or normal saline following completion of the operation. There were 17 patients in the bupivacaine group, and 18 in the saline group. Both the patient and the evaluator remained blinded as to the group assignment. The study protocol was reviewed and approved by the local research ethics committee and all patients gave informed consent.

Patients over the age of 18 years were eligible for inclusion. Exclusion criteria included allergies to any of the drugs used, the use of oral opioids or non-steroidal anti-inflammatory drugs (NSAIDs) in the previous seven days, spinal or epidural anaesthesia/analgesia, and pregnancy. The circulating theatre nurse carried out the randomisation during the operation using a sealed envelope technique.

All patients received a premedication dose of dispersible diclofenac 100 mg and a standardised general anaesthetic consisting of an intravenous dose of propofol sufficient to obtund the eyelid reflex, fentanyl 1 µg/kg and maintenance with isoflurane in a mixture of 66% nitrous oxide in oxygen. Patients breathed spontaneously via a laryngeal mask airway. Monitoring included automated recording of the arterial pressure, electrocardiogram, pulse oximetry and capnography.

A standard arthroscopy technique was used. Mechanical distraction was applied to the

Table I. Patient data

	Bupivacaine (n = 17)	Saline (n = 18)	p-value
Gender			
M:F	8:9	13:5	0.18
Age in yrs (range)	45.9 (19 to 76)	41.8 (20 to 72)	0.407
Tourniquet time in min (range)	44.7 (35 to 65)	43.6 (30 to 65)	0.723
Intra-operative fentanyl in µg (range)	110.3 (100 to 150)	109.7 (100 to 200)	0.942
Recovery room analgesia tramadol in mg (range)	44.1 (0 to 250)	91.7 (0 to 250)	0.009
Number of co-codamol tablets taken after discharge (range)	5.18 (0 to 12)	6 (0 to 16)	0.628

Fig. 1

Visual analogue scale pain scores (mean and SD) as a function of time. Scores measured pre-operatively, 30 minutes, one, two and 12 hours post-operatively on the day of surgery, and at 8 am, 2 pm and 10 pm on the day after surgery (* indicates $p < 0.05$).

ankle with a Guhl ankle strap soft-tissue distractor (Smith and Nephew, Memphis, Tennessee). The ankle was distended with saline and the anteromedial portal was created with a No. 15 blade and a 2.7 mm diameter arthroscope inserted. The anterolateral portal was made using a transillumination technique avoiding the superficial peroneal nerve.

At the end of the procedure an intra-articular injection of either 20 ml normal saline or 20 ml 0.5% bupivacaine was given as appropriate. The tourniquet was deflated ten minutes later, and this was taken as the start time for the study.

In the recovery room supplementary analgesia of two tablets of co-codamol 30/500 orally, tramadol 50 mg to 100 mg intravenously (IV) up to a maximum of 250 mg, and morphine 1 mg to 10 mg IV were available on request. The recovery staff recorded the quantities administered. On discharge, patients were given a ten-day supply of diclofenac (50 mg, eight-hourly, to take regularly), and in addition co-codamol 30/500 (two tablets, six-hourly to take as required). Patients were asked to document the number of co-codamol tablets taken and the time.

The analgesic effect was assessed by a direct subjective measure of pain intensity, using a visual analogue scale (VAS). The requirements for co-codamol as an additional analgesic

were also monitored as an indirect indicator of the intensity of the pain. The patients were instructed pre-operatively in the use of the VAS. This was a 100 mm line with 0 marked as 'no pain' and 100 as 'the worst pain imaginable'. Recordings were made before operation and then on the day ward 30 minutes, 1 hour and 2 hours after release of the tourniquet. The patients then recorded their VAS scores after discharge at 12 hours after operation, and at 8 am, 2 pm and 10 pm the next day. The operating surgeon (SP) was not involved in recording the VAS or in the collection of the completed forms.

The sample size was estimated by an equation appropriate for comparing two independent group means. The power of the study was calculated prior to commencement of the trial. Based on a standard deviation of 20 mm for the VAS,⁷ a group of 20 patients would be sufficient to detect a difference of 18 mm on the VAS at a 5% level of significance with 80% power. However, after recruitment of 35 patients, the introduction of new European legislation (EU Directive 2001/20/EC)⁹ necessitated halting the trial to implement fresh documents and procedures. In view of the additional costs and time involved in implementing these practices we did not feel able to continue with the study and the data were unblinded and analysed.

Statistical analysis. The data are shown as mean (SD) values unless otherwise stated, and unpaired two-tailed *t*-tests were used to compare the differences between the groups. Data that were not normally distributed were analysed using the Mann-Whitney U-test. Categorical values were analysed using the chi-squared test. A *p* value < 0.05 was considered to be significant. All analyses were carried out using SPSS for Windows version 10 (SPSS Inc., Chicago, Illinois).

Results

There were no significant differences between the two groups in age, gender or tourniquet time (Table I) and the pre-operative VAS scores were similar for the two groups. Both groups had an equal number of patients who had undergone arthroscopic debridement. The VAS scores were normally distributed.

The post-operative VAS scores were significantly lower in the bupivacaine group on the day of operation (Fig. 1) 30 minutes ($p = 0.013$), 60 minutes ($p = 0.001$) and 120 minutes after the procedure ($p = 0.010$). There was a trend towards a lower VAS score at 12 hours following arthroscopy ($p = 0.07$). Although the mean VAS scores were lower for the bupivacaine group on the day after operation, the results were not statistically significant.

The use of IV tramadol for post-operative analgesia in the recovery room was less in the bupivacaine group (44.1 mg *vs* 91.7 mg, $p = 0.009$). Four patients (24%) in the bupivacaine group required tramadol, as opposed to 15 (83%) in the saline group, and an additional four patients (22%) in the saline group also required morphine. The use of co-codamol for additional analgesia following discharge was similar in both groups. One patient in the saline group returned to the Accident and Emergency department for additional analgesia after discharge. There were no side-effects or complications associated with the use of bupivacaine.

Discussion

Following arthroscopy of the ankle, pain is routinely managed with oral opioids and anti-inflammatory medication. These are administered by the patient, but may result in inadequate pain relief. Persistent pain may delay discharge from hospital, reduce the ability to participate in a rehabilitation programme and delay recovery. Total or optimal analgesia is difficult to achieve with a single drug or method. A multimodal analgesic regimen utilises the synergistic effects, allowing the use of smaller doses of supplementary analgesia with a concomitant reduction in side effects.¹⁰

Intra-articular administration of bupivacaine 0.5% or less does not appear to be detrimental to the articular cartilage and was used because of its extended duration of action compared with that of other local anaesthetics.^{3,11}

The study by Rasmussen and Kehlet⁸ assessed the effect of intra-articular glucocorticoid, morphine and bupivacaine and demonstrated an initial analgesic effect, with a

prolonged difference between their treatment and placebo groups. This may be accounted for by the addition of morphine and corticosteroid. However, there was one infection in their treatment groups, and in view of this we did not feel that the addition of corticosteroid was prudent.

Bupivacaine is a longer-acting local anaesthetic amide but still has a relatively short half-life of approximately three to four hours. The main benefit of intra-articular bupivacaine was in the first eight hours, and in view of this the addition of other adjuvants, such as an opioid or clonidine, may provide longer-lasting analgesia.

We recommend the use of intra-articular bupivacaine following arthroscopy of the ankle as it significantly reduces the initial levels of pain and the requirements for analgesics after operation. Further studies are required to assess the benefit of other adjuvants.

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