INTRAOPERATIVE BUPIVACAINE DIMINISHES PAIN AFTER LUMBAR DISCECTOMY

A RANDOMISED DOUBLE-BLIND STUDY

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A randomised double-blind study was carried out on 60 patients undergoing elective lumbar discectomy. Patients in the study group (n = 30) received an injection of 10 ml of 0.5% bupivacaine into the wound; the control group (n = 30) received none. Postoperative pain was measured by a visual analogue pain scale and by the amount of morphine administered by a patient-controlled analgesia system. Patients in the study group had lower pain scores, used less morphine, waited longer until their first demand for analgesia and reported their postoperative pain to be less severe.

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The control of postoperative pain remains one of the least satisfactory aspects of modern surgical and anaesthetic practice, as was recognised in a recent report from the Royal College of Surgeons of England (1990). The common orthopaedic procedure of lumbar discectomy can cause severe postoperative pain.

Bupivacaine is a local anaesthetic solution widely used for wound infiltration in a variety of clinical settings with beneficial results. Hashemi and Middleton (1983) found that intraoperative bupivacaine diminished postoperative pain after herniorrhaphy and Bourne and Johnson (1988) reported a similar effect in patients who had had foot surgery. These were all rather minor surgical procedures; our study investigated whether wound infiltration with bupivacaine provided analgesia after major spinal surgery.

PATIENTS AND METHODS

After approval of the protocol by our Medical Research Ethical Committee, 60 healthy patients presenting for elective lumbar disc decompression consented to enter the study. During the preoperative visit they were taught to use a 100 mm visual analogue pain scale (VAS) on which 0 and 100 were designated 'no pain' and 'worst pain imaginable'. The use of a patient-controlled analgesia system (PCAS) was also explained. This is a computer-controlled infusion pump which administers an intravenous bolus of morphine in response to the patient pressing a demand button. The size of the bolus, the interval between successive boli, and the maximum cumulative morphine dosage are preset by the investigator. The pump automatically records the time and number of patient demands, and whether or not they are successful.

All patients were premedicated with temazepam 20 mg orally. On arrival in the operating theatre an intravenous infusion of dextran 70 was given as prophylaxis against deep-vein thrombosis, and a standardised general anaesthetic consisting of morphine sulphate 0.1 mg/kg intravenously plus droperidol 2.5 mg as an antiemetic. Anaesthesia was induced with thiopentone and maintained using isoflurane in a nitrous oxide/oxygen mixture. Muscle relaxation was produced with atracurium and antagonised with glycopyrrolate/neostigmine. Immediately before wound closure the patient was randomly allocated to either the study group or the control group. Those in the study group received an injection of 10 ml of 0.5% plain bupivacaine into the wound, 5 ml laterally into the erector spini muscle (after release of the retractors) and 5 ml subcutaneously along both margins of the wound. The control group received no injection. After operation the patients were returned to a dedicated orthopaedic high-dependency unit where VAS scores were recorded at 1, 2, 4, 8, 16 and 24 hours postoperatively by nursing staff who did not know to which group the patient belonged. The PCAS was set to deliver a 2 mg bolus of morphine with a 20-minute lockout period. The nurses were authorised to administer further doses (0.1 mg/kg) of intravenous morphine if the patient complained of severe pain. On the day after surgery we calculated the total postoperative morphine

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Fig. 1

Mean cumulative postoperative morphine consumption (mg) in the two groups.

consumption, the consumption per hour after the first use of the PCAS, and the interval between the end of the operation and the first demand for analgesia. The patients were also asked if they rated their postoperative pain as none, mild, moderate or severe.

The results were analysed using analysis of covariance, the Mann-Whitney U test and the chi-squared test as appropriate. A *p* value of < 0.05 was accepted as statistically significant.

RESULTS

There were no significant differences between the groups with respect to age, weight, sex, duration of operation or blood loss (Table I). Analysis of covariance indicated that the differences between the means of these variables did not influence the outcome measures.

The postoperative pain scores were consistently lower in the study group but this difference was statistically significant only in the first four hours (Table II). The overall pain scores of the study group were significantly ($p < 0.02$) less than those of the control group.

The morphine consumption was significantly less in the study group. The total and hourly morphine requirements are shown in Table III and the cumulative dosages in Figure 1.

Significantly fewer patients in the study group (5) described their postoperative pain as severe compared with the control group (13; $p < 0.05$).

DISCUSSION

The problem of providing adequate postoperative analgesia persists despite advances in surgery and anaesthesia. Analgesia is still often no better than that provided by the haphazard administration of intramuscular opioid analgesics. Although their administration can be im-

Table I. Clinical and operative details (mean $\pm$ SD) of the two groups

	Study group (n = 30)	Control group (n = 30)
Male:female	18:12	19:11
Age (yr)	41.4 $\pm$ 12.33	43.0 $\pm$ 12.47
Weight (kg)	70.4 $\pm$ 10.78	73.6 $\pm$ 11.88
Duration of surgery (min)	60.4 $\pm$ 18.38	53.6 $\pm$ 20.28
Blood loss (ml)	111 $\pm$ 121	109 $\pm$ 108

Table II. Postoperative VAS scores (mm; mean $\pm$ SD; range)

Time after operation (hr)	Study group (n = 30)	Control group (n = 30)
1	30.3 $\pm$ 23.19 (0 to 76)	41.4 $\pm$ 24.43 (2 to 99)
2	21.2 $\pm$ 17.76* (0 to 58)	39.8 $\pm$ 24.57* (1 to 96)
4	23.5 $\pm$ 24.76† (0 to 81)	37.1 $\pm$ 25.74† (0 to 90)
8	21.8 $\pm$ 23.86 (0 to 98)	28.6 $\pm$ 25.16 (1 to 86)
16	21.3 $\pm$ 19.02 (0 to 69)	23.5 $\pm$ 22.89 (0 to 90)
24	24.6 $\pm$ 23.41 (0 to 82)	29.2 $\pm$ 20.45 (0 to 87)

* difference between groups, $p < 0.01$

† difference between groups, $p < 0.05$

proved by the use of the PCAS, opioid analgesics have side-effects such as nausea, vomiting and respiratory depression. The ideal analgesic agent should be effective, have no side-effects and provide prolonged pain relief and this study demonstrates that intraoperative bupivacaine measures up to these criteria. There was no case of

Table III. Postoperative total and hourly morphine consumptions and time to first analgesic demand (mean $\pm$ SD) with mean difference between the groups (95% confidence intervals)

	Study group (n = 30)	Control group (n = 30)	Mean difference (95% CI)
Total morphine (mg)	37.0 $\pm$ 17.19*	50.9 $\pm$ 19.14*	13.9 (4.34 to 23.46)
Hourly morphine consumption after first demand (mg/hr)	1.85 $\pm$ 0.787*	2.41 $\pm$ 0.845*	0.56 (0.14 to 0.98)
Time to first analgesia (min)	144.1 $\pm$ 121.80†	54.8 $\pm$ 60.63†	89.3 (39.5 to 138.9)

* difference between groups, $p < 0.02$ † difference between groups, $p < 0.001$

an adverse reaction and no wound complications. Pain relief was not complete, and morphine was still required, but the length of time that the patient remained painfree was increased, subsequent pain scores were reduced, and postoperative morphine requirements were significantly reduced. It might have been expected, once pain had occurred, that the hourly postoperative morphine consumption would thereafter have been similar in the two groups. In fact, in the study group it remained below that of the control group for the duration of the study, in keeping with previous reports that the duration of pain relief outlasts the expected duration of action of the analgesic (Young 1987; Brull et al 1992). This observation is important since the time to the first request for analgesia has been criticised by McQuay (1992) as a misleading measure of success. He suggested that the period of analgesia provided by local anaesthetics may be followed by severe pain, a rebound effect resulting in an increase in analgesic consumption. McQuay stated that the total analgesic requirements should be considered as well as the length of time that the patient remained painfree. Evidence from other studies has suggested, however, that prompt reduction of noxious afferent input reduces the likelihood of prolonged and chronic pain, perhaps by reducing spinal-cord hyperexcitability (Woolf 1983; Wall and Woolf 1986; Wall 1988). This may explain why the analgesic effect in our study persisted beyond the expected duration of drug action.

Conclusion. Intraoperative infiltration of the wound with

0.5% bupivacaine after disc surgery prolongs the period until further analgesia is required and reduces post-operative pain and morphine requirements. It is a quick, simple, safe and effective means of improving the patient's comfort.

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REFERENCES

- Bourne MH, Johnson KA. Postoperative pain relief using local anesthetic instillation. *Foot Ankle* 1988; 8:350-1.
- Brull SJ, Lieponis JV, Murphy MJ, Garcia R, Silverman DG. Acute and long-term benefits of iliac crest donor site perfusion with local anesthetics. *Anesth Analg* 1992; 74:145-7.
- Hashemi K, Middleton MD. Subcutaneous bupivacaine for post-operative analgesia after herniorrhaphy. *Ann R Coll Surg Eng* 1983; 65:38-9.
- McQuay HJ. Pre-emptive analgesia. *Br J Anaesth* 1992; 69:1-3.
- Royal College of Surgeons of England. *Pain after surgery*. Report of a working party. London: Royal College of Surgeons of England/Royal College of Anaesthetists, 1990.
- Wall PD. The prevention of postoperative pain (Editorial). *Pain* 1988; 33:289-90.
- Wall PD, Woolf CJ. The brief and the prolonged facilitatory effects of unmyelinated afferent input on the rat spinal cord are independently influenced by peripheral nerve section. *Neuroscience* 1986; 17:1199-205.
- Woolf CJ. Evidence for a central component of post-injury pain hypersensitivity. *Nature* 1983; 306:686-8.
- Young DV. Comparison of local, spinal and general anesthesia for inguinal herniorrhaphy. *Am J Surg* 1987; 153:560-3.