Continuous Epidural Infusion for Postoperative Pain Relief: A Comparison of Three Regimens

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We evaluated the postoperative pain relief and side-effects of continuous epidural infusion of three analgesic regimens following major thoracic and/or abdominal surgery. One hundred and twenty patients were randomly divided into three treatment groups: (1) 0.25% or 0.5% bupivacaine at a rate of 3–7 ml·hr⁻¹, (2) 0.01% morphine at a rate of 1–2 ml·hr⁻¹, (3) a combination of 0.125% or 0.25% bupivacaine and 0.0025% or 0.005% morphine at a rate of 2–4 ml·hr⁻¹. The study continued for the first 48 postoperative hours. The effect of pain relief was evaluated by assessment of the further requirement for parenteral analgesics. Sixty-four percent of the patients given bupivacaine, 56% of the patients given morphine and 80% of the patients given the combination required no supplemental analgesics. Continuous epidural infusion of bupivacaine was associated with hypotension (21%) and with numbness and weakness of hands or legs (18%). Continuous epidural infusion of morphine was associated with pruritus (18%) and with peristaltic depression (12%). The combination regimen was associated with pruritus (17%) and with drowsiness (14%). We conclude that the combination of bupivacaine and morphine significantly provides superior analgesia with less deleterious complications compared with either bupivacaine or morphine alone.

(Key words: postoperative pain, epidural, morphine, bupivacaine)


At our hospital, continuous postoperative epidural infusions of both bupivacaine and morphine have been in use for several years. In addition, our practice has evolved to combine morphine with dilute solution of bupivacaine. The purpose of this study is to compare the efficacy of three epidural infusion regimens in terms of their effects to produce postoperative analgesia and the side-effects following various major surgeries. The solutions used contained either bupivacaine or morphine alone, or a mixture of the two.

Methods

Subjects

Every patient was interviewed the night before surgery.

Notes:

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Postoperative pain relief can be achieved more efficaciously by means of continuous infusion techniques than by intermittent injections of analgesics which are invariably given after pain has developed. Postoperative analgesia provided by epidural infusion of local anesthetics or opioids has been described after abdominal and thoracic surgery. Although it is obvious that these methods can be effective, there has been no published work comparing various epidural infusion regimens in Japan.
before surgery by one of the investigators to explain the purpose of the study and to obtain consent. Patients who met all the following criteria were considered eligible for entry into this study: (1) not contraindicated for the insertion of an epidural catheter (localized infection, septicemia, preoperative coagulopathy); (2) scheduled for thoracic and/or abdominal surgery and; (3) scheduled preoperatively by surgical staff to receive postoperative care in an intensive care unit (ICU) due to either the severity of pre-existing disease(s), the magnitude of the anticipated surgical procedure, or both. All the patients were premedicated with hydroxyzine (25-100 mg) and atropine (0.3-0.5 mg) intramuscularly 1 hr before arrival in an operating room, where an i.v. infusion of lactated Ringer’s solution was commenced. Before induction of general anesthesia an epidural catheter was inserted at the level corresponding to the middle dermatome crossed by the surgical incision. The epidural space was identified by the hanging drop technique. General anesthesia was induced with thiamylal (4 mg·kg⁻¹) followed by succinylcholin (1 mg·kg⁻¹) to facilitate tracheal intubation. Anesthesia was maintained with nitrous oxide, oxygen, halothane, and a low dose of narcotics, and the patients received intermittent injections of plain mepivacaine via the epidural catheter. Non-depolarizing muscle relaxants were used for the control of ventilation, particularly during surgery of the upper abdomen or thorax. On completion of surgery, the patients were transferred to ICU.

**Postoperative analgesia**

A continuous epidural infusion was started immediately after the operation. All the patients were randomly divided into three groups to receive postoperative pain treatment for a 48 hr period as follows: group A – continuous epidural infusion of 0.25% or 0.5% of plain bupivacaine at a rate of 3-7 ml·hr⁻¹; group B – continuous epidural infusion of 0.01% morphine in normal saline at a rate of 1-2 ml·hr⁻¹; group C – continuous epidural infusion of a combination of 0.125% or 0.25% bupivacaine and 0.0025% or 0.005% morphine at a rate of 2-4 ml·hr⁻¹. The use of narcotics being regulated in Japan, the study was not double-blinded, but the patients did not know which drugs were being used. In groups B and C, if pain relief was insufficient, bolus injection of 4 ml of the solution was allowed only twice in succession. In addition, when the patients of all the groups asked for more analgesics or complained of restricted breathing because of pain, supplemental analgesics (usually buprenorphine) were administered intravenously.

Indomethacin was allowed to alleviate fever and benzodiazepines (usually flunitrazepam or diazepam) were used for night sedation.

**Methods of evaluation**

The degree of pain relief was measured by scoring based on the requirement by patients for supplemental analgesics during the first 48 postoperative hours as follows: no analgesics = 0; no analgesics but antifebriles = 1; analgesics only once = 2; analgesics more than once = 3.

Postoperative monitoring of the electrocardiogram, rectal temperature, urinary volume, and respiratory frequency was carried out in accordance with the routines of the ICU. The arterial pressure was measured throughout this study, and blood gas samples were taken at intervals of 6 hr.

All the side-effects related to epidural analgesia were recorded by nurses, and were reported immediately to anesthesiologists for consultation. The incidence of each side-effect in each group was compared. The bladder was catheterized in every case, and so urinary retention could not be assessed.

**Statistics**

The data are expressed as mean ± SD. They were analyzed for statistical significance using one-way analysis of variance, χ² test, and Student’s t-test. *P < 0.05* was considered statistically significant.

**Results**

A total of 120 patients was used in this study, 28 in group A, 34 in group B, and 58 in group C. The profiles of pa-