Continuous Epidural Infusion of 0.05% Bupivacaine Plus Hydromorphone for Labor Analgesia: An Observational Assessment in 1830 Parturients

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Hydromorphone is a mu receptor agonist with pharmacokinetic properties intermediate between morphine and highly lipophilic opioids such as fentanyl and sufentanil (1). In postsurgical settings epidural hydromorphone provides a rapid onset of pain relief, an infrequent incidence of adverse effects, and measurable gains in potency and analgesic duration when compared with equivalent doses given IV (2). Hydromorphone has been evaluated as a neuraxial analgesic for labor and delivery (3).

In a double-blind epidural comparison, parturients treated with hydromorphone reported superior pain control and required less analgesic supplementation than others treated with 50 μg fentanyl. On the basis of these findings, and clinical experience gained over several years (4), hydromorphone is the epidural opioid of choice for labor and delivery analgesia at our institution. In this communication we describe the safety and effectiveness of 100 μg hydromorphone plus bupivacaine 0.25% for epidural induction, followed by continuous infusion of 0.05% bupivacaine with 3 μg/mL hydromorphone in 1830 consecutive parturients.

Methods

This prospective observational analysis was approved by the Yale IRB. Patients in active labor requesting epidural analgesia had catheters placed at the L2-3 or L3-4 interspace and were given 8–10 mL of 0.25% bupivacaine with epinephrine 1:200,000 in divided doses, followed rapidly by 5 mL of normal saline containing 100 μg hydromorphone (Dilaudid HCl®, Abbott Medical Products, Abbott Park IL). Thereafter, a continuous epidural infusion of 0.05% bupivacaine with 3 μg/mL hydromorphone was infused at a rate of 10–14 mL/h, depending upon patient height. Solutions were prepared in 100-mL bags of preservative-free normal saline by the hospital pharmacy and administered via an epidural infusion pump (Pain Management Provider®, Abbott Medical Products, Abbott Park, IL). These solutions offered drug compatibility and long-term stability (5,6). Patients requesting supplemental analgesia were given 2–6 mL bolus doses of 0.25% bupivacaine.

Clinically significant reductions in maternal blood pressure or sustained fetal heart rate decelerations were treated with an IV bolus of lactated Ringer’s solution (250–500 mL) and/or ephedrine 5–10 mg. Patients with nausea and vomiting were given IV metoclopramide (10 mg), whereas those with moderate-to-severe pruritus were treated with IV naloxone 40–80 μg bolus, or a naloxone infusion (0.5–1.0 μg · kg⁻¹ · h⁻¹).

Patients attempting to ambulate or sit at bedside were assessed according to standardized criteria for ambulation, including an absence of orthostatic hypotension (20% reduction in mean arterial blood pressure) and/or clinically significant motor blockade.

After delivery a 10 cm visual analog pain scale was used to provide a global assessment of pain control during labor and delivery. A score of 0–3 cm on the 10-cm scale indicated excellent pain control, 4–5 cm indicated good control, and scores of 6 cm and higher indicated inadequate control.

Data regarding patient demographics, epidural supplementation, global pain scores, and Apgar scores were collected and analyzed using a dedicated Obstetrical Anesthesiology continuous quality improvement...
Results

Observations were performed in nulliparous \((n = 970)\) and multiparous \((n = 734)\) patients, and in patients attempting vaginal birth after cesarean delivery (VBAC) \((n = 126)\). Effective pain relief was achieved within 5–10 min after epidural induction and maintained by the continuous bupivacaine plus hydromorphone infusion. Eighty percent of nulliparas, 82% of multiparas, and 77% of patients attempting VBAC did not require supplemental boluses of 0.25% bupivacaine for the remainder of labor and delivery (Fig. 1). The overall quality of labor analgesia was rated excellent (visual analog pain scale 0–2 cm) by 91%, good by 7%, and poor by 2% of patients. Ninety-five percent of patients met criteria for ambulation; however, only 12% left their bed to sit in a rocking chair, and <5% ambulated with assistance.

No patient experienced respiratory depression or excessive sedation. Hypotension requiring IV ephedrine was observed in 6.6% of patients. Only 2% of patients experienced moderate-to-severe pruritus or nausea that required treatment. Thirty-nine of 1881 infants delivered (2.0%) had 1 min Apgar scores <5. None exhibited signs of opioid-induced respiratory depression or required administration of naloxone.

Discussion

Sevarino et al.1 were the first to test the utility of dilute infusions of epidural hydromorphone for pain relief during labor and delivery. Twenty parturients at 3–5 cm cervical dilation requesting epidural analgesia received an induction dose of 0.25% bupivacaine plus 200 \(\mu\)g hydromorphone followed by an epidural infusion of bupivacaine 0.032% plus 3 \(\mu\)g/mL hydromorphone. All patients in this small series experienced rapid pain relief, with onset of analgesia noted at 5 minutes and peak effect achieved at 10 minutes. However, 30% were troubled by moderate degrees of pruritus and nausea, generally within one hour after epidural induction.

To decrease the incidence of adverse effects the induction dose of hydromorphone was decreased to 100 \(\mu\)g in the present series. This reduction did not influence the quality of epidural analgesia as parturients differing in age, parity, and at varying stages of labor experienced rapid and effective pain relief. The follow-up infusion containing 3 \(\mu\)g/mL hydromorphone maintained reliable labor analgesia despite a reduction in bupivacaine concentration from the standard 0.125% solution we use with epidural fentanyl to 0.05%. As labor progressed, less than 22% of parturients on our busy and highly varied obstetrical service requested epidural supplementation with more concentrated boluses of bupivacaine. The finding that an induction dose and infuse concentrations of hydromorphone were comparable to that advocated for epidural fentanyl underscores its efficacy in this setting, particularly when one considers that hydromorphone’s IV potency is only 1/10 to 1/12 that of fentanyl (1).

Serious adverse effects including excessive sedation, respiratory depression, profound hypotension, and severe fetal bradycardia were not observed and the percentage of patients experiencing clinically significant pruritus and nausea was small.

In conclusion, epidural infusions containing dilute bupivacaine plus hydromorphone provide effective analgesia and a favorable safety profile for parturients of varying parity and stages of labor. Follow-up controlled investigations are needed to assess the effect of bupivacaine plus hydromorphone infusions on the duration and outcome of labor and neonatal neurobehavior.

References


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References