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Epidural Narcotic and Patient-controlled Analgesia for Post-cesarean Section Pain Relief

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The recognition of inadequacies of traditional on demand intramuscular narcotic administration for postoperative analgesia,[1] together with the desire to reduce the side effects traditionally associated with opioids, has led to the development of alternative techniques of narcotic administration. Both the epidural administration of narcotics and patient-controlled analgesia (PCA) apparently are superior to intramuscular (im) administration of narcotics.[2,3] However, no published studies have directly compared epidural narcotics, patient-controlled analgesia, and intramuscular narcotics in a controlled, randomized fashion.

The present investigation was designed to compare these modalities of postoperative analgesia in a randomized prospective study in 60 patients following cesarean delivery.

MATERIALS AND METHODS

Following protocol approval by our Human Investigation Committee, 60 patients undergoing elective cesarean delivery under regional anesthesia were enrolled, and written informed consent obtained. All patients were free of any significant pre-existing disease and had no history of drug or alcohol abuse (ASA I or II). Anesthesia for cesarean delivery was administered *via* an epidural catheter using 2% lidocaine with epinephrine 1:200,000 in a volume sufficient to achieve a T4 sensory level.

Upon enrollment in the study, patients were randomized into three groups for postoperative analgesia. Group A (N = 22) received epidural morphine; this was administered as 5 mg morphine in 10 ml preservative-free saline (Duramorph®) *via* the epidural catheter at the time of clamping of the umbilical cord. Group B (N = 18) patients received PCA. An "analgesic base" of narcotic was provided by iv titration of 5-mg increments of morphine at 15 and 30 min following umbilical cord clamp. Further iv increments were provided, if a request was made, in the recovery room. The patient then received PCA using the Abbott Lifecare® PCA Infuser. The PCA pump was set to administer 2 mg morphine with a lockout interval of 6 min in between doses. The need for an early loading dose of morphine, together with the dose and lockout interval selected, were determined to provide optimal analgesia in a pilot study which preceded this study.

Group C (N = 20) patients received im morphine, 10–15 mg, every 4 h, as requested. In our institution, this dose is routinely ordered by the obstetricians for patients following cesarean delivery.

Patients were observed for 24 h following delivery. A visual analog scale (VAS) was used to evaluate pain; patients were asked to evaluate the intensity of their pain by marking the degree of pain they were experiencing on an unmarked 10-cm line, with 0 representing no pain and 10 worst pain imaginable. Scores were obtained at 2 and 4 h following delivery and 4 h thereafter. Pain scores thus obtained were graded as "mild" (VAS 0–3), "moderate" (VAS 4–7), and "severe" (VAS 8–10). Other observations included presence of pruritus and its treatment, nausea and vomiting, and respiratory rates. Patient comments regarding the level of satisfaction with their analgesic regimen were noted and,

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at the end of the study period, patients were asked if they would use this route of analgesia again if it were available. Total duration of hospital stay was also noted.

Results were analyzed using three-way ANOVA with Tukey and paired *t* tests where appropriate ($P < 0.05$ is considered significant).

Results

There was no difference in age, height, weight, parity, or volume of local anesthetic used between the three groups.

Figure 1 shows the incidence of mild, moderate, and severe pain in each of the three groups. Mild pain (VAS 0–3) was reported in 85% of patients in group A *versus* 60% and 45% of patients in groups B and C, respectively. There was a statistically significant higher incidence of reports of mild pain in the epidural group *versus* PCA and im ($P < 0.05$). In contrast, patients in group B did not have significantly lower pain scores when compared to group C.

Temporal relationship of pain scores is shown in figure 2. The significantly lower scores in the patients in group A were present until 16 h following delivery. Beyond 16 h, there was no statistically significant difference in mild pain scores between the three study groups.

The incidence of nausea and vomiting and the need to treat it was the same in all three groups (P = NS).

Figure 3 shows the incidence of pruritus in all three groups. Forty-five per cent of patients in group A required treatment for pruritus *versus* 11% in group B and 6% in group C ($P < 0.05$). Pruritus in group A was unresponsive to hydroxyzine or diphenhydramine, but resolved with incremental iv doses of naloxone diluted to 0.04 mg/ml. Patients in groups B and C requiring

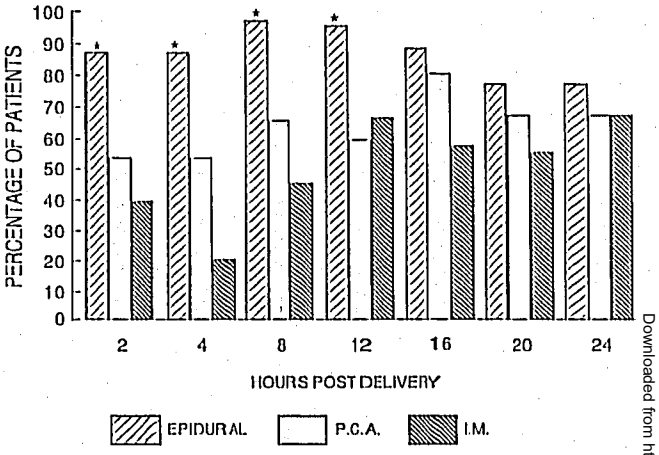

FIG. 2. The percentage of patients in each of the study groups reporting mild pain (VAS 0–3) at each of the observation points. *$P < 0.05$ (epidural *versus* PCA and im). All of the remaining patients experienced moderate or severe pain.

treatment for pruritus received hydroxyzine, 50 mg im, with resolution of their pruritus.

Two patients in group A, both undergoing repeat cesarean deliveries, stated that they would not like to receive epidural morphine for subsequent cesarean deliveries because of the severity of pruritus. All patients receiving PCA stated that they would like to receive this form of analgesia, if given the option, for subsequent deliveries.

There was no difference in respiratory rates (P = NS) between the three groups, and no reports of a decrease in respiratory rate below 10/min.

There was no difference in amount of morphine administered between patients in group B and C (table 1).

The duration of hospital stay was the same in all three groups (table 2).

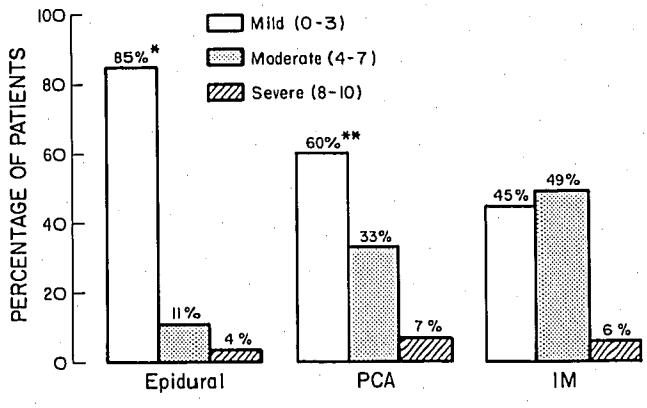

FIG. 1. The percentage of patients in each group reporting mild (VAS 0–3), moderate (VAS 4–7), or severe (VAS 7–10) pain during the 24-h study period. *$P < 0.05$ denotes epidural *versus* PCA and im. **P = NS denotes PCA *versus* im.

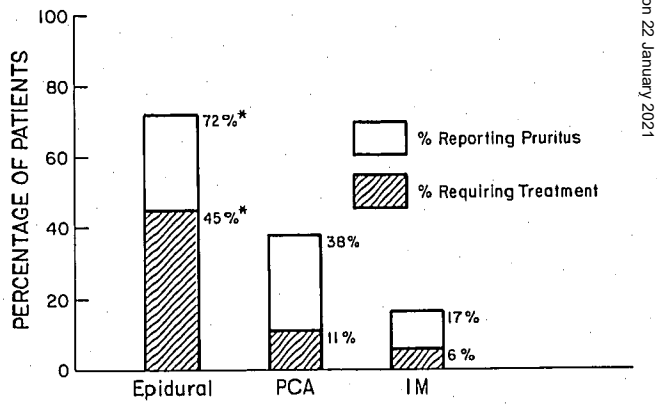

FIG. 3. The percentage of patients in each group reporting pruritus. The cross-hatched area indicates the percentage of patients requesting treatment for pruritus. *$P < 0.05$ (epidural *versus* PCA and im).

TABLE 1. Amount of Morphine (mg) Used in Groups B and C over the 24-h Study Period (Mean ± SD)

Group	Amount of Morphine (mg)
B (PCA)	74.2 ± 21
C (im)	76.2 ± 17

P = NS.

TABLE 2. Total Hospital Stay (Days) (Mean ± SD)

Group	Total Hospital Stay (Days)
A	5.6 ± 0.8
B	5.4 ± 0.9
C	5.6 ± 0.5

P = NS.

DISCUSSION

The post-cesarean section patient differs from others recovering from general surgery in that her overall satisfaction with postoperative analgesia is influenced by her desire/ability to interact with her newborn. Thus, modalities capable of providing superior analgesia with minimal sedation would appear most useful in this setting. Our study is the first in which pain relief provided by newer methods of morphine administration have been carefully compared with traditional intramuscular dosing in patients recovering from the same surgical stimulus.

In terms of analgesic quality, that provided by epidural morphine was superior to the two other modalities tested and resulted in significantly lower visual analog pain scores during the first 16 h following delivery. Our findings differ from an earlier general surgical study in which no analgesic advantage was noted in patients treated with epidural morphine or on-demand iv fentanyl.[4] That investigation, however, only reported pain scores at 2 and 24 h following surgery, and may have utilized an inadequate dose of epidural narcotic, while patients required large amounts of intravenous fentanyl. A more recent comparison in patients recovering from gynecological surgery[5] substantiated our findings; however, these investigators may have reduced the overall effectiveness of PCA by employing a lower dose than first previously reported to be effective.‡

The fact that the percentage of patients experiencing mild pain lacked significance after 16 h may be attributed to two factors. First, patients are approaching the reported dose-related analgesic duration of epidural morphine.[6,7] Second, pain levels and analgesic requirements may have declined to levels more easily controlled by parenteral morphine, although no patients in this group requested supplemental analgesia during the 24-h study period.

In contrast to previously reported PCA studies, we were unable to demonstrate superior analgesia or decreased narcotic requirements when individuals self-administering morphine were compared with traditionally treated patients. While there was no difference in 24-h narcotic requirements, the high doses required in PCA and im groups (groups B and C) reflect the fact that, unlike general surgical patients, parturients in this study received no premedication and had no residual narcosis from general anesthesia. Thus, a loading dose and frequent early maintenance boluses in PCA patients and significant doses in the im group were required to control the rapid onset of severe pain following resolution of epidural anesthesia. Pain scores in patients utilizing PCA correlate directly with a minimum effective plasma concentration of morphine (MEC), calculated to be 20 ng/ml or 2 mg/h in a 70-kg patient.[8] The finding that MEC is a dynamic definition of analgesia and influenced by variability in patient perception and more painful surgical procedures may explain why our patients required a ⅓ higher morphine dosage. It should also be appreciated that an MEC of 80–90 ng/ml is safely tolerated and that plasma morphine concentrations are several-fold higher than this following im administration.[8]

The potential advantages of epidural analgesia have to be balanced against associated morbidity and the greater risks of the technique.[9] In this regard, the epidural group had the highest incidence of side effects, most notably pruritus. In prior studies, the incidence of pruritus has ranged from 0–100% with no relationship between incidence and dose.[9–12] Nevertheless, we were surprised by the severity of itching, level of patient dissatisfaction, and percentage requiring treatment. While delayed respiratory depression remains a most feared complication of epidural morphine, the small number of patients evaluated and frequent need for naloxone infusions precludes any comment except that respiratory rates were similar to the im and PCA groups. In spite of the extremely low reported incidence of significant respiratory depression in this patient population (0.4%),[13] specialized nursing care is required, and it is not always available in smaller obstetrical units.

Patients with pre-existing medical conditions or obstetrical complications may not be candidates for epidural anesthesia. In the above setting, PCA may provide a useful alternative to epidural analgesia. Despite significantly higher PCA pain scores than those observed in

‡ White PF: Patient-controlled analgesia: A new approach to the management of postoperative pain. Seminars in Anesth IV: 255–266, 1985

patients receiving epidural morphine, patient satisfaction with the relief obtained was comparable. Factors responsible for the lack of correlation between apparent pain and increased pain tolerance and satisfaction may be related to a more uniform level of analgesia, a lack of troublesome side effects, independence, and an awareness that reliable analgesia will be provided quickly as required. Patients utilizing PCA morphine did not achieve total analgesia, but settled at a level in which comfort was balanced by troublesome side effects, *i.e.*, increasing sedation, nausea, and dizziness. It may well be that morphine is not the optimal narcotic for use in PCA. An agent with faster onset, less sedation, and fewer adverse effects might further increase patient satisfaction and increase levels of analgesia to levels achieved with epidural narcotics.

In summary, two newer modalities of providing postoperative pain relief offered either superior analgesia or higher patient satisfaction than traditional im dosing. Epidural morphine offers the best possible analgesia if one is willing to accept higher morbidity and risks of delayed respiratory depression. In settings where epidural narcotics cannot be administered, the high patient satisfaction and uniform analgesia offered by PCA provides an attractive alternative.

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Venous Air Embolism during Removal of Tissue Expander in a Supine Child

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Venous air embolism (VAE) is a well-known complication of neurosurgical procedures, especially those done in the sitting position.[1,2] Additionally, isolated case reports have also appeared in the literature describing VAE in adults and children having a variety of extra-cranial procedures performed.[3–11] We describe a case in which venous air embolism occurred in a child having a large scalp flap raised after it had been delayed and enlarged with a tissue expander.

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Case Report

A 14-month-old boy had a tissue expander placed in a sub-galeal pocket to delay and expand a scalp flap in preparation for removal of a giant nevus. Anesthesia consisted of halothane, N_2O, and O_2. A 4.5-mm ID oral endotracheal tube was inserted during paralysis from