Epidural fentanyl does not influence intravenous PCA requirements in the post-Caesarean patient

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Forty ASA physical status I or II patients scheduled for elective Caesarean delivery were studied to determine the effect of epidural fentanyl on post-Caesarean delivery analgesic requirements as administered by intravenous patient-controlled analgesia (PCA). Following delivery of the infant, under epidural anaesthesia with lidocaine 2% with 1/200,000 epinephrine, patients were randomly assigned to receive either 10 ml of preservative-free normal saline via the epidural catheter or 100 μg of fentanyl with 8 ml preservative-free normal saline in a double-blinded fashion. On arrival in the post-anesthesia recovery room (PAR), patients were provided with intravenous PCA meperidine 12.5 mg every eight minutes as needed. Patients were visited at intervals over the next 24 hr to determine if any differences in narcotic requirements, demands for narcotics, or severity of pain were noted. No differences were observed in any values between the groups. It is concluded that a single bolus of epidural fentanyl does not provide an advantage for postoperative pain relief in this patient population.

Quarante patientes ASA I et II cédulées pour une césarienne furent étudiées afin de déterminer l'effet de l'épidurale au fentanyl sur le besoin d'analgésie postopératoire avec la technique de PCA. Après l'accouchement de l'enfant sous anesthésie épidurale avec la lidocaïne 2% et 1/200,000 d'épinéphrine, les patientes furent randomisées afin de recevoir soit 10 ml de soluté physiologique sans préservatif à travers le cathéter épidural ou 100 μg de fentanyl avec 8 ml de soluté physiologique sans préservatif d'une façon doublement à l'insu. A l'arrivée en salle de réveil, on a mis à leur disposition la PCA intraveineuse avec la mépéridine 12,5 mg chaque huit minutes au besoin. Les patientes furent visitées par intervalle pour les prochaines 24 heures afin de déterminer s'il y avait des différences dans la demande pour narcotique, et on a noté aussi la sévérité de la douleur. Aucune différence ne fut observée dans aucune des valeurs entre les groupes. On conclut qu'un bolus unique de fentanyl par voie épidurale ne fournit aucun avantage dans le soulagement de la douleur postopératoire dans cette population de patientes.

Key words
ANAESTHESIA: obstetrical;
ANALGESIA: epidural, postoperative;
LOCAL ANAESTHETICS: lidocaine;
OPIOIDS: fentanyl.

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Fentanyl, a potent lipophilic opioid, provides effective epidural analgesia following Caesarean delivery[1,2] and general surgery.[3,4] High-lipid solubility confers clinical advantages over morphine, including rapid onset of analgesia and reduced potential for delayed respiratory depression.[5,6] Rapid decrease in CSF fentanyl concentrations due to uptake and, to a lesser degree, elimination, limits the duration of analgesia produced by epidural fentanyl.

At our institution over 90% of patients recovering from Caesarean delivery performed under epidural anaesthesia elect to receive *iv* PCA. In this setting the reliability, rapid onset, and limited duration of epidural fentanyl analgesia appear to smooth the transition from resolution of local anaesthetic blockade until effective pain relief is noted with PCA. The following double-blind investigation which permitted patients to initiate and to self-administer narcotics postoperatively via a PCA system was designed to measure the duration of postoperative analgesia and assess the overall benefit of epidurally administered fentanyl in patients following Caesarean delivery performed under epidural anaesthesia using 2% lidocaine.

Methods

The protocol was approved by the Human Investigation Committee of Yale University School of Medicine, and written informed consent was obtained from each patient before entry into the study. Forty ASA physical status I or II patients scheduled for elective Caesarean delivery were enrolled into the study. Before initiation of anaesthesia, patients were instructed in the use of PCA and were prehydrated with 1500 ml of lactated Ringer's solution. An epidural catheter was inserted at the third lumbar interspace and anaesthesia to the third or fourth thoracic dermatome was achieved using carbonated 2% lidocaine with 1:200,000 epinephrine. The patients were positioned supine with a right hip roll to produce a pelvic tilt of approximately 15° to the left.

After delivery of the baby, 40 patients were randomly assigned to receive either 10 ml of preservative-free normal saline or 100 μg of fentanyl (Sublimaze®, Janssen Pharmaceutica, Piscataway NJ) with 8 ml preservative-free normal saline (10 ml total volume) in a double-blinded fashion. On arrival in the PAR (time 0), patients were connected via *iv* tubing to a PCA pump (Lifecare II®, Abbott Medical Products, Chicago, IL). The PCA pump was programmed to deliver meperidine 12.5 mg every eight minutes with a maximum dose of 300 mg over any four-hour interval.

The times between epidural fentanyl administration and arrival in the PAR and time of first PCA dose were recorded. A 10 cm visual analogue scale (VAS) for pain with 0 = pain-free and 10 = worst pain imaginable was used to measure the severity of pain at time 0, and at 1, 2, 4, 8, 12 and 24 hr following arrival in the PAR. At these evaluation intervals similar VAS scale was used to assess satisfaction (0 = completely dissatisfied and 10 = completely satisfied). The total amount of *iv*-PCA meperidine administered at each interval in the first 24 hr was determined, as were the number of times the patient self-administered meperidine (PCA bolus) and attempted to self-administer meperidine but was prevented by the lockout procedure (PCA attempt). Patients were observed for and questioned about side-effects including pruritus and nausea at each interval.

Sample size (n = 40) was determined based on difference between groups reported in similar patient populations.[1] Data were analyzed using Student's paired t-test, Chi-square analysis and Wilcoxon Rank Sum Test, with statistical significance accepted at $P \leq 0.05$. Data are reported as the mean ± SD.

Results

There were no demographic differences between groups (Table). Three patients were eliminated from data analysis: one had inadequate regional anaesthesia requiring general anaesthesia, and two were withdrawn when they requested that the PCA be discontinued.

There were no differences between groups with respect to the duration of epidural anaesthesia, as assessed by resolution of motor blockade and sensory blockade to pinprick. There were no significant differences in the times between injection of the study drug and arrival in the PAR (time 0), 44.9 + 12.1 min in patients given epidural saline and 48.7 + 11.3 min in those given fentanyl.

There were no significant differences between groups with respect to time between epidural fentanyl administration and the first PCA dose. Patients given epidural fentanyl injected their first PCA dose after 150.0 ± 20.2 min, compared with 146.7 ± 50.8 min in patients given epidural saline. Pain scores at the time of first PCA narcotic administration and throughout the duration of the study were not different between groups (Figure 1). Total meperidine dose administered at each interval and at 24 hr was the same in both groups (Figure 2). The number of PCA boluses and PCA attempts were similar in both groups.

Side-effects in both groups were minimal, and differences between groups were statistically insignificant; nausea occurred in two of the patients given epidural saline, and in one patient who was given epidural fentanyl. Pruritus occurred in one individual in each group. There were no complaints or observations of excessive sedation or inadequate pain relief in any patient.

Discussion

In the present study, analgesia provided by epidurally administered fentanyl appeared to have negligible postoperative benefit and did not delay patient initiation of PCA or influence the total amount of patient self-administered meperidine. Epidural fentanyl did not appear to smooth

TABLE Patient characteristics

	N	*Height (cm)*	*Weight (kg)*	*Gravidity*	*Parity*	*Duration of surgical anaesthesia (min)*	*Total dose of lidocaine (ml)*
Fentanyl	20	162.5 ± 1.2	78 ± 12	2 ± 1	1 ± 0.7	104.2 ± 22.8	23.0 ± 4.6
Saline	17	162.6 ± 1.6	78 ± 16	2 ± 1	1 ± 0.7	99.5 ± 13.8	23.4 ± 7.2

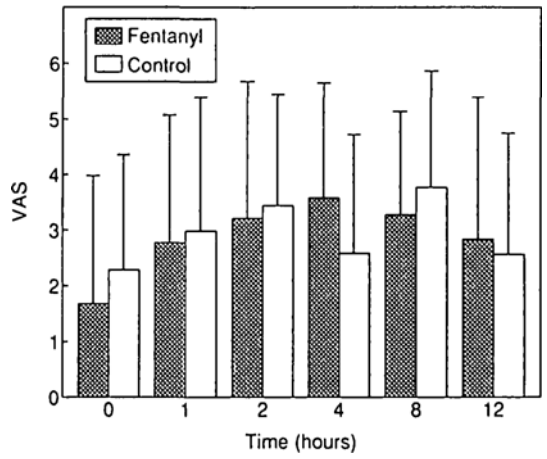

FIGURE 1 Visual analogue pain scores versus time following epidural injection of either 100 μg fentanyl in 8 ml normal saline (10 ml total volume) or 10 ml normal saline.

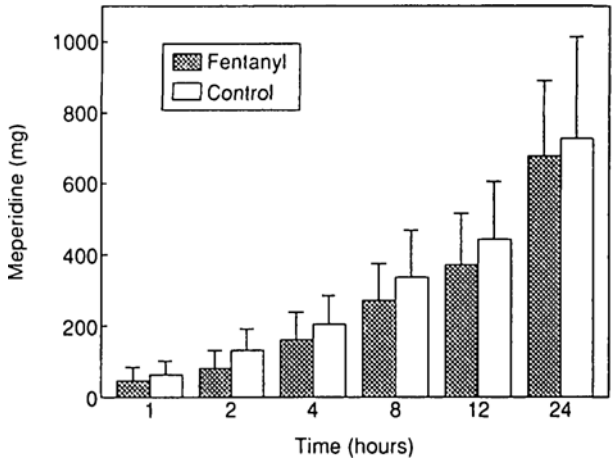

FIGURE 2 Total meperidine requirements at intervals following epidural injection of either 100 μg fentanyl in 8 ml normal saline (10 ml total volume) or 10 ml normal saline.

transition to PCA therapy as pain scores in the fentanyl group throughout the early postoperative period were similar to those observed in the control group. However, with the small differences between groups seen in our patients, unlike in Naulty's cohort,[1] we can state only that the difference in pain relief and difference in narcotic use between groups was much less than previously reported. A larger cohort needs to be examined to determine if indeed no difference exists between groups.

This apparent lack of efficacy may be in part related to the local anaesthetic employed and to our use of a protocol which permitted the patient, rather than a nurse or study evaluator, to determine analgesic effect and need for additional pain medication. By permitting patients to have ready access to pain medication using *iv*-PCA, we provided a more reliable means of assessing pain relief and analgesic requirements following epidural fentanyl. McQuay *et al.*[7] found that effectiveness of pain relief provided by epidural opioid injection appeared to correlate inversely with PCA narcotic usage.

In an initial evaluation Naulty and co-workers[1] reported that fentanyl (75–100 μg) provided 4–5 hr of complete analgesia and reduced 24-hr parenteral narcotic requirements in parturients recovering from Caesarean delivery performed using epidural anaesthesia 0.75% bupivacaine. It is probable that this potent long-acting agent, contributed to the effectiveness and duration of postoperative analgesia. Subsequent studies[2,8,9] using a local anaesthetic with a shorter duration of action have been unable to duplicate these findings and report at most only 1–2 hr of analgesia after Caesarean delivery. All these studies provided epidural anaesthesia with a local anaesthetic other than 0.75% bupivacaine. Malinow *et al.*[2] reported only 45 min of complete pain relief as measured by VAS in patients given epidural fentanyl following 0.5% bupivacaine or 2% lidocaine with epinephrine 1:200,000. Similarly, Madej *et al.*[4] reported a 1–2 hr duration of epidural fentanyl analgesia following Caesarean delivery under epidural anaesthesia with 2% lidocaine with epinephrine 1:200,000.

The differences observed in the duration of postoperative analgesia in the above studies compared with the results using 0.75% bupivacaine may reflect residual but clinically imperceptible local anaesthetic activity that persists and potentiates fentanyl analgesia.[10,11]

Due to cardiovascular toxicity, bupivacaine 0.75% is now contraindicated for use in parturients and in most institutions has been replaced by lidocaine for epidural anaesthesia for Caesarean delivery. We conclude that a single bolus of epidural fentanyl does not provide any great advantage for postoperative pain relief in clinical obstetric anaesthesia to patients receiving intravenous PCA for postoperative analgesia.

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