Subcutaneous fentanyl for the management of acute pain in infants and children

Joseph D. Tobias
Departments of Anesthesiology & Pediatrics, University of Missouri, Columbia, Missouri 65212

Introduction: Although opioids are usually administered either by the intravenous route for the treatment of moderate to severe acute pain, specific situations may preclude the use of IV opioids. For example, a patient may be receiving multiple medications, which are physically incompatible and have only a single site for IV access or there may be difficulties with obtaining or maintaining intravenous access. In such cases, the non-intravenous route may be chosen. Studies in adults have demonstrated the efficacy of subcutaneous opioids for the control of terminal cancer pain, postoperative pain, and acute pain. We present our experience with the subcutaneous administration of fentanyl in a cohort of Pediatric ICU patients.

Methods: Pharmacy records and the Pediatric ICU admission book were reviewed and pediatric patients identified who had received subcutaneous infusions of opioids. The following demographic data were obtained: age, weight, gender, and underlying medical problems including those, which necessitated the administration of opioids. The use of parenteral opioids prior to the administration of subcutaneous opioids, the dose and duration of the subcutaneous opioids infusion were noted. The efficacy of the technique was evaluated by retrospective analysis of pain or withdrawal score data when available. Any adverse effects occurring following the switch to subcutaneous opioids were evaluated for their potential association with the opioid infusion. All data are presented as the mean $\pm$ SD.

Results: Twenty-four patients were identified who had received subcutaneous fentanyl. The patients ranged in age from 2 weeks to 18 years (5.0 $\pm$ 3.1 years) and in weight from 3.3 to 45 kilograms (20.4 $\pm$ 10.6 kg). There were 15 boys and 9 girls. For subcutaneous administration, a concentrated solution of fentanyl (50 mcg/mL) was used and the maximum infusion rate was less than 3 mL/hr. The subcutaneous infusion was started at a dose equivalent to the current intravenous infusion rate of fentanyl. Several sites of the body were used including the subclavicular, deltoid, anterior thigh, or abdominal wall. After EMLA cream had been in place for 1-2 hours, the site was cleaned with iodine and alcohol. A 23-gauge butterfly needle or a standard intravenous catheter was inserted into the subcutaneous tissue. Prior to placement, the tubing and needle were flushed with the concentrated fentanyl solution so that the deadspace of the catheter and/or tubing contained fentanyl. After insertion into the subcutaneous tissue, the insertion site and needle or angiocatheter were covered with a sterile bio-occlusive dressing. The site was changed every 7 days or sooner if erythema develops. The same infusion pumps that are used for intravenous administration were used for subcutaneous administration; however, the pressure limits were increased. The duration of the infusion ranged from 1.5 to 14 days (5.6 $\pm$ 2.1 days). The indication for opioids included gradual weaning following prolonged opioid use in 14, acute pain issues in 7, and the provision of comfort during terminal stages of an illness in 3. Of the 7 acute pain issues, 4 of these were postoperative surgical pain and 3 were acute pain related to medical illnesses (trauma, mucositis, and respiratory failure with the need for mechanical ventilation in 1 patient each). The reason for choosing the subcutaneous route was lack of intravenous access in 16 patients and drug incompatibilities with limited intravenous access in the other 8 patients. The only adverse effect noted was the need to change the site prior to the usual 7-day limit in 2 patients. This was because of the development of erythema in one patient and complaints of point tenderness at the infusion site in a second patient. As assessed by pain and withdrawal scales, an adequate effect was achieved in all patients except for 3 patients who manifested a pain score of 5 or greater. These patients were treated with either a subcutaneous or intravenous bolus dose of fentanyl followed by an increase in the infusion rate.

Discussion: The current cohort of patients adds further experience regarding the use of subcutaneous opioids in pediatric-aged patients. The technique was effective in 3 different clinical scenarios including acute pain management, comfort during the terminal stages of illnesses, and gradual weaning of opioid administration following prolonged intravenous administration during long-term ICU illnesses. In these cases, the subcutaneous route was used when there was no intravenous access or drug incompatibilities precluded the intravenous route.