Inadvertent Administration of Sufentanil Instead of Fentanyl during Sedation/Analgesia in a Community Hospital Emergency Department: A Report of Two Cases

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Abstract. The authors report two cases of inadvertent administration of sufentanil instead of fentanyl during patient sedation/analgesia in a community hospital emergency department (ED). Both cases resulted in reversible adverse drug events (ADEs) to the respective patients. In tracing the steps involved in the cause of these errors, the authors discovered several components common to identified pathways that result in ADEs. These include similarities in product packaging appearance and names of these two medications, along with nursing unfamiliarity with the medications. Medication "sound-alikes" and "look-alikes" continue to be a source of potential error in the ED. **Key words:** sufentanil; fentanyl; medication error; adverse drug events. ACADEMIC EMERGENCY MEDICINE 2000; 7:1282–1284

WE REPORT two cases of medication error that occurred during a single shift at a rural community hospital in southern Indiana. The emergency department (ED) cares for approximately 9,000 patients per year (25 patients per day). The hospital contains 82 beds, and has 2,600 annual admissions, of which 1,600 occur through the ED (four patients per day, 16% of the ED volume).

CASE 1

A 15-month-old male presented to the ED by ambulance after sustaining a grand mal seizure at home. He had respiratory symptoms for two days prior and had a temperature of 102°F noted by the mother just before the seizure. The seizure was reported by the mother to have lasted between 4 and 5 minutes. The child had been healthy, except for contracting "many colds," and had never been hospitalized. The patient's mother had sustained a seizure during the third trimester of pregnancy.

The treating physician decided to perform a lumbar puncture in order to rule out meningitis. Because the child was unable to be adequately restrained for the lumbar puncture, a decision was made to sedate him. The physician wrote an order for 1.5 mg of midazolam intravenously, followed by 20 μg of fentanyl (1.5 μg/kg). The child received the midazolam without difficulty. The nurse's note next documents the administration of "20 micrograms of fentanyl" intravenously. Three minutes later, the child was reported to be sleeping but arousable. Five minutes after the medication had been given, the oximetry reading had fallen below 89% and the child was reported to be unresponsive. Within 8 minutes of receiving the fentanyl, the child became apneic, cyanotic, and flaccid. His pulse decreased to 66 beats/min and his oximetry dropped into the 60% range. A nasal trumpet was inserted, and the child underwent bag–mask ventilation by the physician. This resulted in an increase in the heart rate to 110–120 beats/min, and the oximetry increased above 90%. Naloxone and flumazenil were administered, and over the ensuing 15 minutes the child returned to his premedication baseline state. The physician questioned the nurse about the quantity of fentanyl that was administered, and was assured that only the 20 μg had been given. He therefore believed that this was an atypical reaction to the combination of benzodiazepine and opioid agent.

CASE 2

Approximately two hours after the arrival of the child, a 45-year-old man was transported by ambulance after his vehicle crossed the median on the interstate highway and collided between two semitrucks that were passing each other. He had been unrestrained and there was no airbag deployment. At the scene he was reported to be awake and com-

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plaining of severe neck and leg pain. The patient admitted to the use of marijuana, injectable cocaine, and alcohol earlier in the evening. He was never hemodynamically unstable in the field, and on arrival in the ED his pulse was 87 beats/min, blood pressure 161/102 mm Hg, respiratory rate 24 breaths/min, and temperature 96.4°F. The patient was noted to have a right occipital skull fracture, a fracture of the dens and lamina of C2, a spiral fracture of the left tibia, and a widened mediastinum on chest radiograph. For this reason, aeromedical transfer was arranged. Approximately 10 minutes prior to the arrival of the air ambulance, the physician decided to administer pain medication due to continued patient complaints of neck and leg pain. He ordered 100 μg of fentanyl intravenously (patient's weight was 80 kg). A second nurse administered one half of the ordered dose due to her concerns about what had happened to her colleague when she had administered the medication to the child in case 1. She documented "fentanyl 50 micrograms" on the nursing record. Five minutes later, she noted that the patient underwent a dramatic fall in his oximetry reading from 100% to 70% to no reading at all. He became unresponsive, flaccid, and apneic, and his heart rate decreased from 112 beats/min to 60 beats/min. An oral airway was placed, and the patient underwent bag–mask ventilations. Naloxone, 2 mg, was administered, and over the ensuing 3 minutes the patient became more arousable and could answer questions. It was a total of 10 minutes before the patient was deemed to be at baseline by the physician.

The physician subsequently renewed his investigation into the medication used for both of these patients. Although the medication drawer from which they were dispensed was labeled "fentanyl," the packaging identified the contents to be sufenanil. Neither the nurses nor the nursing supervisor realized that the two medications were different, and in fact the nursing supervisor insisted on looking up the medication in a text because she was convinced that they were one and the same. In discussions with the pharmacist, it was subsequently determined that the same pharmaceutical company supplied both medications. Both were packaged in identical dark brown sleeves containing 10 vials each. The vials were identical in color and size (2-mL ampules). The sufentanil ampule contained 1 mL of medication at a concentration of 50 μg/mL. The fentanyl ampule contained 2 mL of medication at 50 μg/mL. In the pharmacy, the two medications are stocked on opposite sides of the wall, with the sufentanil shelf labeled "for OR use only." Nevertheless, the pharmacy technician on duty that day had inadvertently stocked the ED opioid (narcotic) drawer with sufentanil instead of fentanyl.

DISCUSSION

The incidence of medication adverse events has increased over the last decade. Over a nine-year period, Lesar et al. found increases in total errors per 1,000 patient days, in total errors per 100 admissions, and in total errors per 1,000 medication orders.[1] In examining systems elements that contribute to adverse drug events (ADEs), Leape et al. noted that 28% of ADEs stemmed from error, and that 21% had errors in more than one stage of drug ordering and delivery.[2] These stages were divided into physician ordering errors, transcription errors, pharmacy dispensing problems, and nursing administration errors. Leape et al. additionally noted that sound-alike names and look-alike packaging were prominent causes of identity errors. In that study, dose and identity checking errors were the second most common cause of systems failures resulting in errors. Interestingly, the largest percentage of ADEs in this study population stemmed from opioid analgesics.[3] However, a study conducted at a later time in a tertiary teaching hospital found that the wrong drug was administered in only 5% of total medication error cases, and opioids were involved in only 3.6% of all medication errors.[4] Over a nine-year period at this hospital, the administration of the wrong drug accounted for only 4.1% of the total medication errors, and opioids were involved in 5.7% of the total medication prescribing errors.[1]

The ED is an area for high-risk potential of ADEs. In 1991 Leape et al. noted that although the ED was the site of only 3% of total adverse events, 70% of the adverse events resulted from negligence.[5] In that study, negligence was defined as "failure to meet the standard of care reasonably expected of an average physician qualified to take care of the patient in question" and was determined by two independent chart reviewers. Of the ADEs identified in the ED, 25% resulted in serious disability. While drug treatment caused only 9% of the errors leading to adverse events, the use of an inappropriate drug accounted for 22% of the drug therapy errors.[5] In another tertiary teaching hospital, the ED rate of prescribing errors per 1,000 medication orders was 5.5, the second highest in the facility, behind pediatrics.[1]

Both fentanyl and sufentanil are synthetic opioid agents used extensively in the operating room as preinduction analgesics. Fentanyl is widely used in EDs for analgesia, and in combination with benzodiazepines for sedation–analgesia during painful procedures, while sufentanil's use is largely limited to the operating room. An in-vitro animal study found sufentanil to be approximately 10 times as potent as fentanyl.[6] A study in healthy male volunteers determined that sufentanil produced much deeper sleep, for longer per-

TABLE 1. Common Factors Associated with Nursing Medication Errors

Nurse not familiar with differences between similar-sounding medications
Medication storage system storing two similar medications in proximity
Absence of a second check system (checking actual medication and dose against the physician order)

iods of time, and higher rates of apnea necessitating stimulation at doses one-tenth of fentanyl.[7] The febrile child's weight was estimated to be 13 kg, and 20 μg of fentanyl was ordered verbally by the physician and written by the nurse. It is estimated that the child instead received 20 μg of sufentanil. Likewise, although the nurse documented the order of 100 μg of fentanyl for the man injured in the motor vehicle crash (and the administration of one-half of that dose), the patient actually received 50 μg of sufentanil. This is similar to the child's receiving a bolus dose of 200 μg of fentanyl, and the adult 500 μg of fentanyl. The clinical effects may have been exacerbated by the concomitant use of midazolam in the child, and by the combination of recreational drugs and ethanol in the adult. Both patients quickly and temporally showed signs and symptoms compatible with massive opioid overdose following the administration of the medication.

These cases demonstrate well a chain of errors that culminated in the administration of the incorrect medication to two patients over a brief time in a community hospital ED. The most likely cause of these ADEs stems from a "systems error" created by the "look-alike" appearance of both the individual ampules and the packaging sleeves. This caused the initial error when the pharmacist dispensed the wrong medication to be stocked in the ED. The pharmacy technician likewise failed to notice that the incorrect medication had been provided, and placed it in the ED locked opioid drawer in the space normally used for fentanyl.

Second, due to the "sound-alike" nature of fentanyl and sufentanil, the nurses did not recognize the difference between the two medications. In spite of the physician clearly requesting (verbally and written order) fentanyl, the nurse administered sufentanil instead. Although she noted the difference in spelling, she assumed that sufentanil was simply another name for fentanyl. This error might have been prevented if she had used the "check-back" and "call-back" techniques using the exact name of the medication she was administering to the patient. These techniques have been recently advocated by the MedTeams research consortium as a method to improve team communication in the ED.[8] The MedTeams Project investigated an emergency care teamwork system based on a successful error reduction program used in military aviation. Using these techniques, the nurse would have verified the physician's order verbally prior to actually administering the medication. Table 1 lists common factors associated with nursing medication errors.[9]

The nurses at this hospital had never received any formal inservice training about conscious sedation and specifically the use of fentanyl, although all stated that they had used it extensively during inpatient work as well as in the ED. Due to these ADEs, the pharmacy changed vendors for the sufentanil, and the current packaging does not look like the fentanyl packaging.

CONCLUSIONS

We describe two cases of iatrogenic opioid overdose caused by a cascade of medical errors. The pharmacist who dispensed the incorrect medication initiated this sequence. The pharmacy technician who delivered the incorrect medication to the ED dispensing drawer perpetuated the error. Look-alike packaging is likely to have been the underlying source of this "systems" error. The marked similarities between the two medications, both visually (packaging, number in the sleeve, and size of the ampule) and in spelling and pronunciation, resulted in the nurses' failing to recognize that they were administering the incorrect medicine. These cases demonstrate the dangers of "look-alike" and "sound-alike" medications, as well as failure to use "check-backs" to improve ED team communication.

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