Safety and Patient-Controlled Analgesia
Part 2: How to Prevent Errors
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Patient-controlled analgesia (PCA) has considerable potential to improve pain management. However, errors happen frequently, sometimes with tragic consequences. Part 1, “How Errors Occur,” was the topic of last month’s Medication Errors column. This month, Part 2 presents a checklist of efforts related to practice, systems, products, PCA pumps, and regulations that can help reduce the risks associated with this patient-centered technology.

Purchasing a PCA Pump
• The actual PCA pump to be evaluated should be subject to a failure mode-and-effects analysis. Here are some sample questions to consider:
  o Can the pump be easily programmed to deliver the desired concentrations?
  o Might unsafe administration accidentally allow free flow to occur?
  o Will clinicians and patients intuitively know how to operate the pump?
  o What are the default settings for the opiate concentrations in use?
  o Do the drugs, units of delivery, and strengths appear in a logical sequence?
• PCA pumps should be limited to a single model to promote proficiency with programming.
• Before distributing the new pumps, the staff should verify that all pump default settings are set up as expected.
• A warning label stating “For Patient Use Only” should be placed on the activation button.

Before PCA Is Prescribed or Dispensed
• Prescribers of PCA must undergo a privileging (credentialing) process to verify their proficiency with this form of pain management.
• Only anesthesia staff members, the pain-management team, or critical-care prescribers may order fentanyl for epidural PCA.
• Standard order sets should be designed to guide drug selection, doses, and lockout periods; patient monitoring; and precautions. Order sets should provide instructions on how and when to administer oxygen and naloxone.
• Concomitant analgesics should be avoided.
• The pump’s programming sequence should be used to test the sets in order to reduce the risk of errors.
• After receiving instruction, nurses should:
  o be familiar with the opiates used for PCA.
  o recognize the dangers of administering a dose for the patient (known as “PCA by proxy”).
  o understand the differences between hydromorphone (e.g., Dilaudid, Abbot) and morphine.
  o be able to identify the signs and symptoms of opiate toxicity and withdrawal.
  o know when to assess patients showing a minimal response to verbal or tactile stimulation.
  o know how to distinguish between oversedation and other pulmonary, neurological, or cardiovascular complications.
• Both nurses and pharmacists should be taught how to program PCA pumps; their ability to enter a PCA prescription accurately should be verified.
• Training should take place close to the time when new pumps are introduced, not months beforehand.
• Practice sessions should be offered as needed to maintain proficiency.
• Simulations should be run in which staff members intentionally write incomplete orders, select an inappropriate drug or dose, misprogram a pump, ignore double checks, forget critical monitoring points, and overlook obvious signs of toxicity so that clinicians can identify the behaviors that place patients at risk.
• Clinicians should be provided with ongoing education to increase their awareness about PCA errors.
• Personnel are encouraged to report PCA errors within their institution as well as to the Food and Drug Administration, the Institute for Safe Medication Practices, and the U.S. Pharmacopeia.
• Competency assessments should be required each year for all professionals who prescribe, dispense, and administer PCA.
• Criteria should be established for selecting patients who would be eligible to use PCA.
• PCA candidates should have an appropriate level of consciousness and a cognitive ability to self-manage pain. Infants, young children, and confused patients are unsuitable candidates for PCA.

Prescribing PCA
• PCA standard order sets are required, and all sections must be completed.
• The number of verbal orders to change doses should be kept as low as possible.
• Orders for PCA opiates are always written in milligrams or micrograms, not in volume (milliliters).
• The staff should check for patient allergies before selecting an opiate to be used for PCA.
• Morphine is the opiate of choice. Hydromorphone can be used for patients who need very high doses of opiates. Meperidine (Demerol, Sanofi-Aventis) should be reserved for patients who are allergic to both morphine and hydromorphone.
• To determine loading and maintenance doses, the staff should take into account other medications that the patient has received (e.g., analgesics taken at...
home, intraoperative medications) or is currently taking (e.g., antihistamines, nighttime sedatives).

- The appropriateness of PCA therapy should be reassessed at regular intervals.

**Dispensing PCA**

- One standard concentration should be established for each opiate used for PCA.
- Only standard concentrations of morphine and hydromorphone should be stocked in patient-care units. Meperidine for PCA should be dispensed from the pharmacy.
- To avoid mix-ups, personnel should separate stored hydromorphone from morphine in the pharmacy as well as in patient-care units.
- Any patient allergies should be listed in the interactive-allergy field in the patient’s profile before PCA orders are entered into the computer.
- Maximum dose limits for PCA opiates should be set in the pharmacy computer so that an alert appears if a safe dose is exceeded during order entry.
- If an opiate is being dispensed in a non-standard concentration, staff members should affix a prominent warning to the label.
- Prefilled syringes, bags, and cassettes should be used whenever possible. The pharmacy should prepare all PCA products that are not commercially available.
- A pharmacist should review all PCA orders before PCA is initiated unless the pharmacist is off-site.
- The pharmacist should suggest renal dose adjustments or an alternative opiate when appropriate.
- If meperidine is used for PCA, the pharmacy should set dose limits and should reassess the patient every 24 hours.
- “Tall man” lettering should be used on pharmacy-applied labels for HYDROMORPHONE to help prevent confusion with morphine.
- Clinicians should be alerted to potential drug shortages of PCA opiates. If a shortage is encountered, an alternative drug with clear dosing instructions should be recommended.

**Initiating PCA**

- All patient allergies should appear prominently on the medication administration record (MAR) before PCA is begun.
- PCA should be connected to a port close to the patient to avoid dead space, and the infusion line should be prominently labeled at this connection to avoid mix-ups with other lines.
- Laminated instructions for programming PCA pumps should be provided for nurses who initiate PCA only rarely.
- Two clinicians should independently double-check the patient’s identification, the drug selected and its concentration, the PCA pump settings, and the line attachment before PCA is used and before a pump refill or a programming change is made.
- Bedside bar-coding can be used to verify the patient and the drug concentration, but pump settings might still need to be double-checked.
- Nurse-controlled PCA should be avoided unless special monitoring is in place.
- PCA settings should be verified during each shift immediately after an updated report about the patient’s condition is received.
- Concomitant opiates should not be administered; an alert should appear on the medication administration record to this effect.
- Oxygen and naloxone should be readily available.
- Patients should be taught about the proper use of PCA during the preoperative testing visit so that they are not too groggy to understand.
- Family members and visitors should be warned about the danger of PCA by proxy.

**Monitoring the Effects of PCA**

- A standard measurement scale should be established to assess the patient’s level of pain.
- Monitoring requirements should be developed for patients who are receiving PCA. At a minimum, the patient’s level of pain, alertness, vital signs, and rate and quality of respirations should be evaluated every four hours.
- The staff must be alert for signs of oversedation.
- To accurately assess the level of sedation, personnel should evaluate all patients showing a minimal response to verbal or tactile stimulation.
- Patients should be monitored more frequently during the first 24 hours and at night, when hypoventilation and hypoxia tend to occur.
- The staff should become familiar with risk factors that can increase respiratory depression (e.g., obesity or low body weight, concomitant medications that potentiate opiates, and pre-existing conditions such as asthma and sleep apnea).
- The staff should determine the level of enhanced monitoring (e.g., capnography, apnea alarms at night) that would be required if these patients use PCA.
- Staff members should identify the infrequent situation in which critical-care patients might be suitable for nurse-controlled analgesia and should indicate the level of enhanced monitoring that would be required for these patients.
- Health care personnel should not rely on pulse oximetry readings alone to detect opiate toxicity. Because capnography is currently not available for all PCA patients, its use should be reserved for patients with a heightened risk of toxicity and for patients who are appropriate candidates for nurse-controlled analgesia.
- Flow sheets should be kept at the bedside to document the PCA doses and patient monitoring.
- The use of naloxone should be monitored to identify PCA-related adverse events.

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The reports described in this column were received through the USP–ISMP Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on the ISMP (www.ismp.org) or the USP (www.usp.org) Web site or communicated directly to ISMP by calling 1-800-FAILSAFE or via e-mail at ismp-info@ismp.org.