



High-Alert Medications *and* Safe Practices

A STUDY GUIDE FOR NURSES

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General safety principles

The following safety principles are applicable to the administration of all medications:

- Two unique patient identifiers should be assessed prior to administering medications. Reliable choices include those on the wristband or those that the patient can verbalize, such as name, age/date of birth, and medical record number. Never use room number or location as an identifier.
- Allergy status is assessed prior to administration.
- The nurse understands the medication's intended purpose and ensures the "Five Rights":

1. Right patient
2. Right dose
3. Right route
4. Right frequency
5. Right time

- The nurse documents in a timely manner having checked the five rights.
- The patient is informed of the drug, dose, potential side effects, and any relevant laboratory values.
- "Read back and verify" is performed by anyone receiving a telephone or verbal order.
- Only hospital-approved abbreviations, acronyms, and symbols are used in documentation.
- Many medications have distinctive colors. However, never rely on color to identify a medication.
- Any medication error, near miss, or adverse drug reaction should be reported according to your institution's incident report system policy. You may also report systems (e.g., pumps, dispensing systems, human systems, etc.) that appear vulnerable to error so that they can be improved.
- Consult the pharmacy as a reference for questions.
- Syringes not prepared at the bedside are labeled with the name of the medication and dose.
- A double check system is often used with the administration of certain high-alert medications. Double checks require two clinicians to independently calculate the dose without reviewing prior calculations. This can ensure

1. detection of error before it reaches a patient
2. early identification of systems vulnerable to human error so that they can be improved¹

Reference

1. *The road less traveled*. Huntingdon Valley, PA. Institute for Safe Medication Practices. 2002 August 21.

Opioids

Why are opioids identified as high-alert medications?

Opioids bind with opiate receptors at many sites in the central nervous system (e.g., brain, brain stem, spinal cord, etc.) and peripheral nervous system, and thereby alter both the perception of and emotional response to pain. If they are prescribed, administered, or monitored inappropriately, respiratory depression, coma, and even death can result.

As you read this section, keep in mind these commonly reported problems associated with opioids:

- Misconceptions about addiction, tolerance, dependence, and allergies.
- Misunderstandings regarding equianalgesic dosing of opioids.
- Infusion pump errors with Patient Controlled Analgesia (PCA) and Patient Controlled Epidural Analgesia (PCEA) are frequent.¹
- Oral liquid versions of morphine and oxycodone are available in many concentrations. Mix-ups among them have led to serious overdoses.²
- Allergic reactions occur frequently.³
- Errors related to the drug, concentration, and route.
- Confusion between hydromorphone, morphine, and oxycodone:
 - Hydromorphone intravenous (IV) is five times more potent than morphine IV
 - Oral hydromorphone is about three times more potent than oxycodone
- Families and friends push the PCA or PCEA button, which can lead to serious overdoses.⁴
- Patients receiving opioids may not be adequately monitored. This is critical during the first 24 hours and at night because nocturnal hypoxia occurs most frequently during these periods.⁵
- Confusion has occurred between sustained-release and immediate-release products (e.g., Oxycontin and oxycodone).

Back pain

Below is a case study about a patient who was at risk for overdose because of inappropriate dosing and administration of morphine.

A 58-year-old man with chronic lower back pain is admitted to your unit with a PCA after a laminectomy. His PCA orders read “morphine 2 mg every eight minute bolus with no basal dose.” He was taking Norco (one tablet every six hours) at home for several months prior to the surgery. He is complaining of severe pain, and you notice that his wife is pressing the button on the PCA. What is wrong with this picture?

Source: Northwestern Memorial Hospital Pain Expert Nurse Newsletter (November 2002).

- First, the bolus on a PCA should not be set at eight minutes. Remember that the peak effect of most intravenous opioids is 15 minutes, so boluses given more frequently can lead to accumulation of the drug and potential sedation. Eventually, such accumulation can lead to respiratory depression.
- Second, determine the patient's previous opioid dose. Norco, or 10 mg of hydrocodone, is approximately equal to 10 mg of oral morphine. The patient was taking four doses each day, or 40 mg, which is approximately equal to 40 mg of oral morphine or 13.3 mg of parenteral morphine. Thus, the best method of replacing his previous opioid dose would be to convert the 13 mg of parenteral morphine into a basal rate of approximately 0.5 mg per hour. Contact your pharmacy for assistance.
- Third, to determine whether the bolus dose is correct, ask the patient how much relief he obtains with the 2 mg. If the pain is relieved 100% and he is sedated, then reduce the bolus. If the pain is relieved 100% and he is not sedated, the dose is correct. And if the relief is less than 100%, even with the addition of the basal rate, then increase the bolus dose. Normally we use 50%–100% of the hourly rate, which would be 0.25 mg–0.5 mg. But this dose only replaces his previous Norco dose. Reassessment is critical to determine the effective dose.
- Fourth, educate the patient's wife about the dangers of anyone other than the patient pushing the button on the PCA pendant. Most family members or friends will be responsive. Consult the physician and consider a care conference if they continue to interfere.

Critical thinking

- Is the current regimen providing relief to the patient's satisfaction?
- Does the patient or the patient's family have misconceptions about opioid use? (e.g, fear of addiction, tolerance, dependence, etc.)⁶
- Does the patient have unrealistic expectations of pain control?
- Does a pharmacist need to be consulted?
- Are there any new complaints or physical assessment changes that may relate to the use of the pain medications?
- Is there an appropriate bowel regimen prescribed?
- Does the patient have undesirable past experiences with the use of opioids (e.g., effectiveness, adverse effects, history of substance abuse, etc.)?⁷
- Are there concomitant orders for medications that contain acetaminophen? (If so, monitor for total daily doses of acetaminophen.)
- If a PCA is ordered for a patient, is the patient a suitable candidate based on his or her level of consciousness, psychological reasons, or intellectual capacity?

Nursing implications**Administration**

- Opioids may be administered through a variety of routes: oral, transdermal, rectal, and parental (which includes IV, subcutaneous (SQ), epidural, and intrathecal).
- Although some pain medications are prescribed to be administered intramuscularly, this method is not recommended because the absorption is highly variable. Contact the physician to determine alternative routes that may be available.⁸
- Prior to administration, assess baseline
 - pain level
 - sedation level
 - respiratory status
- Verify established opioid use prior to initiating an opioid regimen.
- Assess for treatment contraindications, such as concomitant opioids that have the same duration of action.
- Contact pharmacy regarding potential incompatibility concerns with IV analgesic medications.
- Assess the need for an appropriate bowel regimen to help prevent constipation.

- All opioids are not equianalgesic. For example, 2 mg IV hydromorphone is approximately equal to 10 mg IV morphine.
- Opioids, even at appropriate doses, can suppress respiration, heart rate, and blood pressure. Frequent monitoring is therefore essential.⁹

Monitoring

- Use a pain intensity scale to assess patient's response to treatment. (For further guidance, refer to Exhibit I.1 on p. 12)
- Monitor "PRN" (as needed) use. Decreasing use may indicate decreasing pain, and orders may need to be adjusted.¹⁰
- Monitor
 - respiratory status
 - sedation level
 - nausea/vomiting
 - bowel/bladder function

(For additional guidance on monitoring and assessing respiratory status and sedation level, use the sample sedation scale and respiratory rate monitoring guidelines in Exhibit I.2 on p. 13 for additional guidance.)

- Monitor total daily acetaminophen intake for patients taking combination opioid products (e.g., patients with normal liver function should not receive greater than 4000 mg/day.) (To review the acetaminophen content of several common preparations, refer to Exhibit I.3 on p. 14.)
- Dosing should be reevaluated if the cause or focus of the pain changes (e.g., postoperative, postprocedure, etc.) or is removed (e.g., tubes, renal stones, etc.).

Oral opioids

- Sustained-release oral medications cannot be crushed or split.
- When reviewing medication orders, be vigilant for similar trade and generic names. For example,

Roxanol is morphine (immediate release, liquid)
Roxicodone is oxycodone (immediate release)
and
MS Contin is morphine (long-acting)
OxyContin is oxycodone (long-acting)

- Oral liquid opioids are available in various concentrations, which can be stored in proximity to each

- other. For example, Roxycodone is available in 5 mg/mL bottles or 20 mg/mL bottles.
- Be aware that potencies of IV and oral preparations are not equianalgesic. For example, 30 mg of oral morphine is approximately equal to 10 mg IV/SQ morphine.
 - Note products that combine an opioid and acetaminophen (refer to Exhibit 1.2 on p. 13):
 - Norco contains hydrocodone 10 mg/acetaminophen 325 mg
 - Vicodin contains hydrocodone 5 mg/acetaminophen 500 mg
 - Watch for concomitant orders for acetaminophen, such as
 - *Tylenol Extra Strength, 1–2 tablets po every 6 hours PRN*
 - *Norco, 1–2 tablets po every 4 hours PRN*
 - The total daily dose of acetaminophen should not exceed 4000 mg in patients with normal liver function.

Transdermal opioids

- Remove old patches prior to placing new ones (when appropriate) on alternate sites (e.g., flat sites such as the back or chest are best).
- Treat topical patches like any other medication: chart on the Medication Administration Record when it was administered and on what site.¹¹
- Medication from transdermal patches can be absorbed to a much greater extent in patients with elevated body temperatures (e.g., from a warming blanket or fever). This can lead to significant overdoses.¹²

PCA

- PCA infusions are always used in conjunction with a maintenance intravenous fluid.
- It is recommended that PCA cartridge concentrations be standard throughout an institution. For example, only 1 mg/mL and 0.2 mg/mL are available for use. It is also recommended that colored labels differentiate these concentrations. However, do not rely only on color to differentiate.
- The button should never be pushed by anyone else, including friends or family members.¹³
- Educate patients about the proper use of PCA before initiation. Start during the preoperative testing visit so that patients are not too groggy to understand.¹⁴
- PCA tubing should be changed if there is a medication change or concentration change.
- The pump history should be cleared only if there is a medication change, such as morphine to hydromorphone. If there is only a concentration change, such as hydromorphone 0.2 mg/mL to hydromorphone 1 mg/mL, the history should not be cleared.
- It is recommended that two registered nurses check and verify the PCA pump settings at time of initiation and/or change in dose, medication, concentration, or medication cartridge.
- Research shows that double checks are most effective when conducted independently.¹⁵

PCEA

- PCEA is contraindicated in patients receiving low molecular weight heparin or fibrinolytic therapy.
- No other medications should be infused through the epidural line.
- If a bolus dose is administered through the epidural catheter, the nurse should stay at the bedside during and for five minutes following administration of the bolus dose.
- To avoid overdosing, the maximum bolus volume should not exceed the current hourly rate of infusion.
- The epidural catheter may be left in place after discontinuing the infusion. A lock is placed at the distal end of the catheter and does not need to be flushed. The epidural space is free space and is not prone to clotting.
- It is recommended that two registered nurses check and verify the PCEA pump settings at the time of initiation and/or change in dose, medication, concentration, or medication cartridge.
- Research shows that double checks are most effective when conducted independently.¹⁶

IV opioids

- Verify the concentration on the pharmacy label.
- Calculate the continuous infusion rate and independently check with another nurse or pharmacist.
- Never use a continuous infusion rate for acute pain of a limited duration.¹⁷
- When assessing the need for a possible change in the hourly continuous infusion rate, consider the total usage (including number of bolus doses used) over at least the previous 12 hours. If only the first few hours are considered, the need for an increase in the hourly rate may appear falsely elevated as many times more boluses are required at the initiation of pain control medication until steady-state is achieved.
- To prevent overdosing, bolus doses are preferred to increases in the hourly continuous infusion rate to treat episodic or sporadic pain.¹⁸

Exercise

Your patient's current pain medication orders are as follows:

Tylenol Extra Strength 1–2 tablets po every 6 hours PRN and Norco 1–2 tablets po every 4 hours PRN

It is 2100 and the patient has already received two tablets of Tylenol Extra Strength at 0100, 0700, and 1600 that day. He also has received Norco (two tablets at 1200 after physical therapy). The patient is now requesting two more tablets of Norco before he goes to sleep. What should you do?

Answer provided on p. 57.

Summary points

- Errors associated with opioids are among the most commonly reported incidents that lead to patient harm. Overdoses have occurred due to
 - confusion between different opioids because of sound-alike names.
 - anyone other than the patient pushing the button on the PCA or PCEA.
 - the fact that even at appropriate doses, opioids can suppress respiration, heart rate, and blood pressure. Frequent monitoring is therefore essential.
 - failure to monitor total daily amounts of acetaminophen intake, which can lead to severe liver damage.
- Independent double checks are recommended for rate calculations and infusion pump programming so that errors can be identified prior to administration.

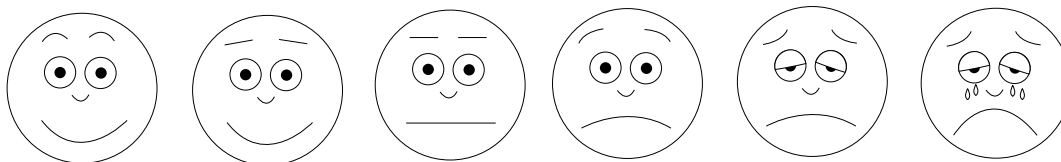
Exhibit 1.1

Patient pain-assessment tool

- It is important to let your doctors and nurses know when you are in pain.
- Point to where the pain is located.
- Describe how the pain feels (e.g., aching, throbbing, or burning). There may be many ways to describe your pain.
- Rate your pain on a scale of 0–10, with 0 meaning no pain and 10 meaning the worst pain you could imagine.

Wong-Baker FACES pain rating scale

0 1 2 3 4 5 6 7 8 9 10
NO PAIN MODERATE PAIN WORST PAIN



Source: Wong D.L., Hockenberry-Eaton M., Wilson D., Winkelstein M.L., Schwarz P.: Wong's Essentials of Pediatric Nursing ed. 6, St. Louis, 2001, p. 1301. Copyright Mosby, Inc. Reprinted with permission.

Exhibit 1.2

Sedation scale and respiratory rate monitoring guidelines

Patient-controlled analgesia (PCA)	Epidural and patient-controlled epidural analgesia (PCEA)
<p>Sedation scale and respiratory rate: every two hours for 24 hours, then every four hours thereafter.</p>	<p>Sedation scale and respiratory rate: every two hours for 24 hours, then every four hours thereafter.</p> <p>Same monitoring frequency following initiation of epidural infusion, after a bolus, and/or increase in rate.</p>

Sedation scale

- 5 Sleeping Normal sleep, respiration rate > 8 per minute
- 0 None Alert, awake
- 1 Mild Responds to normal voice
- 2 Moderate Responds to loud voice/shaking
- 3 Severe Somnolent, difficult to arouse

Sensory motor checks

If *bupivacaine* is used, check lower extremities every two hours, while awake, for the first 24 hours.

- 0 Normal strength and sensation
- 1 Weak but able to bend knees and ankles, normal sedation
- 2 Unable to bend knees, normal sensation
- 3 Unable to move legs, decreased sensation

- Monitor blood pressure every hour for four hours, then every four hours thereafter
- Check orthostatic blood pressure prior to ambulating

Exhibit 1.3

Acetaminophen hepatotoxicity

It is necessary to monitor the total acetaminophen intake for patients taking combination opioid products. The oral adult analgesic dose of acetaminophen is 325 mg–1000 mg. The total daily dose should not exceed 4000 mg. Recognition of the quantities of acetaminophen provided by various combination analgesic products can help to prevent unintended ingestion of potentially toxic doses. The following table details the acetaminophen content of several common preparations.

TRADE NAME	ACETAMINOPHEN CONTENT	OPIOID	NUMBER OF TABLETS/CAPSULES TO REACH 4 G/DAY
Vicodin [®]	500 mg	Hydrocodone 5 mg	8
Vicodin Extra Strength ^{®1}	750 mg	Hydrocodone 7.5 mg	5
Darvocet N-100 ^{®1}	650 mg	Propoxyphene 100 mg	6
Norco [®]	325 mg	Hydrocodone 10 mg	12
Tylenol [®]	325 mg	Not applicable	12
Tylenol Extra Strength [®]	500 mg	Not applicable	8
Tylenol #3 [®]	300 mg	Codeine 30mg	13
Tylenol #4 [®]	300 mg	Codeine 60 mg	13
Percocet-5/325 [®]	325 mg	Codeine 5 mg	12

¹Although effective for many types of moderate to severe pain, combination agents have a maximum or ceiling dose due to the acetaminophen. Thus, Vicodin Extra Strength[®] and Darvocet N-100[®] are not recommended, as their acetaminophen content is high.

It is best to use only one of these agents at a time. When these agents are prescribed at close to the maximum acetaminophen dose, it is necessary to inform patients not to use acetaminophen containing over-the-counter (OTC) analgesics, sinus/allergy medicine, or cough-cold remedies.

Source: Reprinted with permission from Michael Fotis, M.A. (Ed). *Optimizing medication use at NMH: Suggested guidelines for commonly encountered problems*. Chicago: Northwestern Memorial Hospital, 2003.

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9. "More on avoiding opiate toxicity." Huntingdon Valley, PA: ISMP, 2002 May 29.
10. See note 6 above.
11. "Serious consequences if patches are not removed." Huntingdon Valley, PA: ISMP, 2003 June 26.
12. "Elevated skin and body temperatures." Huntingdon Valley, PA: ISMP, 2003 June 30.
13. "Safety issues with patient-controlled analgesia." Huntingdon Valley, PA: ISMP, 2003 July 10.
14. See note 8 above.
15. "Maybe Santa's on to something." Huntingdon Valley, PA: ISMP, 2001 December 12.
16. Ibid.
17. See note 6 above.

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