General anesthesia
(Postoperative Medication and Complications)

I. Postoperative analgesia is provided to minimize patient discomfort and anxiety, attenuate the physiologic stress response to pain, enable optimal pulmonary toilet, and enable early ambulation. Analgesics can be administered by the oral, intravenous, or epidural route.

A. Intravenous route. Many patients are unable to tolerate oral medications in the immediate postoperative period. For these patients, narcotics can be administered i.v. by several mechanisms.

1. As needed (p.r.n.)

a. Narcotics

1. The **intermittent administration of intravenous or intramuscular narcotics by nursing staff** has the potential disadvantages of being given too infrequent, too late, and in insufficient amounts to provide adequate pain control. This may be the only choice in patients who are functionally unable to operate a patient-controlled analgesia (PCA) device.

2. Morphine, 2–4 mg i.v. every 30–60 minutes, or **meperidine**, 50–100 mg i.v. every 30–60 minutes, should provide adequate analgesia for most patients. Orders should be written to withhold further injections for a respiratory rate of less than 12 breaths per minute or in cases of oversedation.

b. Nonsteroidal antiinflammatory drugs (NSAIDs)

1. Ketorolac is an NSAID available in oral and in injectable forms that is an effective adjunct to opioid therapy. The usual adult dose is 30 mg i.m. followed by 15–30 mg every 6 hours.

2. Ketorolac shares the potential side effects of other NSAIDs and should be used cautiously in the elderly and in patients with a history of peptic ulcer disease, renal insufficiency, steroid use, or volume depletion.

2. PCA

a. With PCA, the patient has the ability to self-deliver analgesics within **preset safety parameters**.

b. Patients initially receive either **morphine** (100 mg in 100 mL, with each dose delivering 1 mg), **hydromorphone** (50 mg in 100 mL, with each dose delivering 0.25 mg), or **meperidine** (1,000 mg in 100 mL, with each dose delivering 20 mg), with a maximum of one dose every 10 minutes. If this treatment provides inadequate pain control, the concentration of the drug meperidine can be increased and the lockout time period can be changed.

3. Continuous "basal" narcotic infusions are used rarely to treat patients who require sustained high serum narcotic concentrations. Continuous infusions should be used with great caution and only in patients with adequate monitoring and supervision to prevent respiratory depression and oversedation.

B. Epidural infusions are useful to treat postoperative pain caused by thoracotomy, extensive abdominal incisions, or orthopedic lower-extremity procedures.

Narcotics, local anesthetics, or a mixture of the two can be infused continuously through catheters placed in the patient's lumbar or thoracic epidural space.

C. Oral agents.

D. Side effects and complications

1. Oversedation and respiratory depression a. **Arousable, spontaneously breathing patients** should be given supplemental oxygen and monitored closely for signs of respiratory depression until mental status improves. Medications for pain or sedation should be decreased accordingly.

b. Unarousable but spontaneously breathing patients should be treated with oxygen and naloxone (Narcan). One vial of naloxone (0.4 mg) should be diluted in a 10-mL syringe, and 1 mL (0.04 mg) should be administered every 30–60 seconds until the patient is arousable. Adequate ventilation should be confirmed by arterial blood gas measurement. Current opioid administration should be stopped and the regimen decreased. In addition to continuous pulse oximetry, the patient should be monitored closely for potential resedation as the effects of naloxone dissipate. Naloxone must be used carefully in patients with a history of coronary artery disease.

2. Apnea

a. Treatment involves immediate intubation and ventilation.

b. Naloxone, 0.2–0.4 mg i.v., should be given immediately.

3. Hypotension and bradycardia

a. Local anesthetics administered via lumbar epidurals decrease sympathetic tone to the abdominal viscera and lower extremities and greatly increase venous capacitance. Thoracic epidurals can additionally block the cardioaccelerator fibers, resulting in bradycardia.

b. The **treatment** of choice for any of these situations (excluding bradycardia) is volume resuscitation. Epinephrine can be used to raise BP acutely; 10 mg is diluted in 100 mL and given 1 mL i.v. at a time. If needed, this mixture can be infused i.v. starting at 15 mL per hour (25 μg/min). Bradycardia can be treated with atropine, 0.4–1.0 mg i.v., or glycopyrrolate given i.v. in 0.2-mg increments every 3–5 minutes as needed.

4. Nausea and vomiting

a. Naloxone in small doses (0.04–0.1 mg i.v. p.r.n.) is helpful.

b. Metoclopramide (10 mg i.v. every 6 hours) is also useful.

5. Pruritus

a. Naloxone, 0.04–0.1 mg i.v., is effective.

b. Diphenhydramine, 25–50 mg i.v. p.r.n., may provide symptomatic relief.

6. Monoamine oxidase inhibitors (e.g., isocarboxazid, phenelzine) may, through unknown mechanisms, **interact adversely with narcotics**, resulting in severe hemodynamic swings, respiratory depression, seizures, diaphoresis, hyperthermia, and coma. Meperidine has been most frequently implicated and should be avoided. Although morphine and fentanyl are believed to be safe, narcotics should be avoided whenever possible.

II. Sleeping medications

A. Insomnia is common during hospitalization, and treatment should be readily available. Medications for insomnia taken before admission should be continued.

B. Diphenhydramine (Benadryl) provides an alternative to benzodiazepines. Patients with severe chronic obstructive pulmonary disease or pulmonary hypertension from another etiology should be treated initially with this drug, 25–50 mg p.o., to avoid potential benzodiazepine-induced respiratory depression and hypercapnia. Elderly or debilitated patients also should receive diphenhydramine initially.

C. Zolpidem tartrate (Ambien) is an hypnotic that is used for short-term treatment of insomnia. It is structurally dissimilar to benzodiazepines yet has much or all of its actions explained by its effects on benzodiazepine receptors. It impairs cognitive and motor performance to a greater degree in the elderly and should therefore be closely monitored in this age group.

D. Benzodiazepines (rarely used) include flurazepam, temazepam, and triazolam. Temazepam and triazolam have less “hangover” effects because of a shorter half-life. Starting doses are as follows: flurazepam, 15–30 mg p.o.; temazepam, 15–30 mg p.o.; and triazolam, 0.125–0.25 mg p.o.