

# Central Nervous System Stimulants

## Key Terms

analeptics  
anorexiant

attention deficit disorder  
narcolepsy

## Chapter Objectives

On completion of this chapter, the student will:

- List the three types of central nervous system stimulants.
- Discuss the uses, general drug actions, general adverse reactions, contraindications, precautions, and interactions of the central nervous system stimulants.
- Discuss important preadministration and ongoing assessment activities the nurse should perform on the patient taking a central nervous system stimulant.
- List some nursing diagnoses particular to a patient taking a central nervous system stimulant.
- Discuss ways to promote an optimal response to drug therapy, how to manage common adverse drug reactions, and important points to keep in mind when educating patients about the use of central nervous system stimulants.

The central nervous system (CNS) includes the brain and the spinal cord. The CNS processes information to and from the peripheral nervous system and is the center of coordination and control for the entire body. Many drugs stimulate the CNS, but only a few are used therapeutically. This chapter discusses the drugs that stimulate the CNS and the nursing implications related to their administration.

The CNS stimulants include the **analeptics**, drugs that stimulate the respiratory center of the CNS; the amphetamines, drugs with a high abuse potential because of their ability to produce euphoria and wakefulness; and the **anorexiant**s, drugs used to suppress the appetite.

## ACTIONS

### Analeptics

Doxapram (Dopram) and caffeine (combination of caffeine and sodium benzoate) are two analeptics used in medicine. Doxapram increases the depth of respirations by stimulating special receptors located in the carotid

arteries and upper aorta. These special receptors (called chemoreceptors) are sensitive to the amount of oxygen in arterial blood. Stimulation of these receptors results in an increase in the depth of the respirations. In larger doses, doxapram increases the respiratory rate by stimulating the medulla.

Caffeine is a mild to potent CNS stimulant, with the degree of its stimulating effect dependent on the dose administered. Caffeine stimulates the CNS at all levels, including the cerebral cortex, the medulla, and the spinal cord. Caffeine has mild analeptic (respiratory stimulating) activity. Other actions include cardiac stimulation (which may produce tachycardia), dilation of coronary and peripheral blood vessels, constriction of cerebral blood vessels, and skeletal muscle stimulation. Caffeine also has mild diuretic activity.

Modafinil is an analeptic used to treat **narcolepsy** (disorder causing an uncontrollable desire to sleep during normal waking hours even though the individual has a normal nighttime sleeping pattern). The exact mechanism of action is not known, but the drug is thought to bind to dopamine reuptake carrier sites, increasing alpha activity and decreasing delta, theta, and beta activity,

thereby reducing the number of sleepiness episodes. It is not associated with cardiac and other systemic stimulatory effects of the other CNS stimulants.

## Amphetamines

The amphetamines, such as amphetamine, dextroamphetamine (Dexedrine), and methamphetamine (Desoxyn), are sympathomimetic (ie, adrenergic) drugs that stimulate the CNS (see Chap. 22). Their drug action results in an elevation of blood pressure, wakefulness, and an increase or decrease in pulse rate. The ability of these drugs to act as anorexiant and suppress the appetite is thought to be due to their action on the appetite center in the hypothalamus.

## Anorexiant

The anorexiant, such as phentermine and phendimetrazine, are nonamphetamine drugs pharmacologically similar to the amphetamines. Like the amphetamines, their ability to suppress the appetite is thought to be due to their action on the appetite center in the hypothalamus.

## USES

The CNS stimulants have limited use in medicine. Examples of CNS stimulants are given in the Summary Drug Table: Central Nervous System Stimulants.

## Analeptics

Doxapram is used to treat drug-induced respiratory depression and to temporarily treat respiratory depression in patients with chronic pulmonary disease. This drug also may be used during the postanesthesia period when respiratory depression is caused by anesthesia. It also is used to stimulate deep breathing in patients after anesthesia.

Caffeine and sodium benzoate are administered intramuscularly or intravenously as part of the treatment of respiratory depression caused by CNS depressants, such as narcotic analgesics and alcohol. Because caffeine also has other effects, such as constriction of cerebral arteries and stimulation of skeletal muscles, the use of caffeine for this purpose has largely been replaced by narcotic antagonists for respiratory depression caused by narcotic overdose or other drugs with greater analeptic activity (eg, doxapram). Orally, caffeine, either as a beverage (coffee, tea) or in nonprescription tablet form, may be used by some individuals to relieve fatigue. Caffeine also may be included in some nonprescription analgesics. Modafinil is used to treat narcolepsy to decrease the number of sleepiness episodes during the day.

## Amphetamines

Amphetamines may be used in the short-term treatment of exogenous obesity (obesity caused by a persistent calorie intake that is greater than needed by the body). However, their use in treating exogenous obesity has declined because the long-term use of the amphetamines for obesity carries the potential for addiction and abuse.

These drugs may also be helpful in the management of narcolepsy, a disorder manifested by an uncontrollable desire to sleep during normal waking hours even though the individual has a normal nighttime sleeping pattern. The individual with narcolepsy may fall asleep from a few minutes to a few hours many times in one day. This disorder begins in adolescence or in the young adult and persists throughout life.

Amphetamines are used to manage **attention deficit hyperactivity disorder** (ADHD) in children. Children with this disorder exhibit a short attention span, hyperactivity, impulsiveness, and emotional lability. The condition is more prevalent in boys than in girls and poses a problem with school and learning, although these children are usually of normal or above average intelligence. How amphetamines, which are CNS stimulants, calm the hyperactive child is unknown. These drugs reduce motor restlessness, increase mental alertness, provide mood elevation, produce a mild sense of euphoria, and reduce the sense of fatigue. In addition to taking a CNS stimulant, the child with ADHD may also need psychotherapeutic counseling.

## Anorexiant

Phendimetrazine and phentermine are chemically related to the amphetamines and are used for short-term treatment of exogenous obesity. These drugs are available only by prescription and have addiction and abuse potential. Some nonprescription diet aids contain phenylpropanolamine, an adrenergic drug that has actions similar to the adrenergic drug ephedrine. These diet aids are not true anorexiant, and those containing phenylpropanolamine have limited appetite-suppressing ability when compared to the anorexiant. Phenylpropanolamine also has little abuse potential and has no addiction potential.

## ADVERSE REACTIONS

The adverse reactions associated with the administration of doxapram include excessive CNS stimulation, symptoms of which may include headache, dizziness, apprehension, disorientation, and hyperactivity. Other adverse reactions include nausea, vomiting, cough,

## SUMMARY DRUG TABLE CENTRAL NERVOUS SYSTEM STIMULANTS

GENERIC NAME	TRADE NAMES*	USES	ADVERSE REACTIONS	DOSAGE RANGES
<b>Analeptics</b>				
caffeine <i>kaf-een'</i>	Caffedrine, Stay Awake, <i>generic</i>	Fatigue, drowsiness, as adjunct in analgesic formulation, respiratory depression	Palpitations, nausea, vomiting, insomnia, tachycardia, restlessness	100–200 mg PO q3–4h; caffeine and sodium benzoate: 500 mg–1g IM, IV
doxapram HCL <i>docks'-a-pram</i>	Dopram	Drug-induced postanesthesia, drug-induced respiratory depression, acute respiratory insufficiency superimposed on COPD	Dizziness, headache, apprehension, disorientation, nausea, cough, dyspnea, urinary retention	0.5–1 mg/kg IV
modafinil <i>moe-daf'-in-ill</i>	Provigil	Narcolepsy	Insomnia, nervousness, headache, tachycardia, anorexia, dizziness, excitement	200–400 mg/d PO
<b>Amphetamines</b>				
amphetamine sulfate <i>am-fet'-a-meen</i>	<i>generic</i>	Narcolepsy, attention deficit hyperactivity disorder (ADHD), exogenous obesity	Insomnia, nervousness, headache, tachycardia, anorexia, dizziness, excitement	Narcolepsy: 5–60 mg/d PO in divided doses; ADD: 5 mg BID, increase by 10 mg/wk until desired effect; Obesity: 5–30 mg/d PO in divided doses
dexmethylphenidate <i>dex-meth-thyl-fen- i-date</i>	Focalin	ADHD	Nervousness, insomnia, loss of appetite, abdominal pain, weight loss, tachycardia, skin rash	2.5 mg PO BID; maximum dosage, 20 mg/d
dextroamphetamine sulfate <i>dex-troe-am-fet'-a- meen</i>	Dexedrine, <i>generic</i>	Narcolepsy, ADHD, exogenous obesity	Insomnia, nervousness, headache, tachycardia, anorexia, dizziness, excitement	Narcolepsy: 5–60 mg/d PO in divided doses; ADD: up to 40 mg/d PO; obesity: 5–30 mg/d PO in divided doses
methamphetamine <i>meth-am-fet'-a-meen</i>	Desoxyn	ADHD	Insomnia, nervousness, headache, tachycardia, anorexia, dizziness, excitement	Up to 25 mg/d PO
methylphenidate HCL <i>meh-thyl-fen'- ih-date</i>	Concerta, Metadate ER, Ritalin, <i>generic</i>	ADHD, narcolepsy	Nervousness, insomnia, anorexia, dizziness, drowsiness, headache	5–60 mg/day PO
Pemoline <i>pem'-oh-leen</i>	Cylert	ADHD	Insomnia, nervousness, headache, tachycardia, anorexia, dizziness, excitement	37.5–112.5 mg/d PO
<b>Anorexiant</b>				
benzphetamine HCL <i>benz-fe-ta-meen</i>	Didrex	Obesity	Insomnia, nervousness, headache, dry mouth, palpitations, tachycardia, anorexia, dizziness, excitement	25–50 mg PO 1–3 times/d

### SUMMARY DRUG TABLE CENTRAL NERVOUS SYSTEM STIMULANTS (Continued)

GENERIC NAME	TRADE NAMES*	USES	ADVERSE REACTIONS	DOSAGE RANGES
diethylpropion HCl <i>die-eth'-uhl-pro'-pee-ahn</i>	Tenuate, <i>generic</i>	Obesity	Insomnia, nervousness, headache, palpitations, tachycardia, anorexia, dizziness, excitement	Immediate release: 25 mg PO 3 times/d; Sustained release: 75 mg once daily
phentermine HCl <i>fen-ter'-meen</i>	Ionamin, Pro-Fast, <i>generic</i>	Obesity	Insomnia, nervousness, headache, tachycardia, anorexia, dizziness, excitement	8 mg PO TID or 15–37.5 mg PO as a single daily dose
sibutramine HCl <i>si-byoo-tra-meen</i>	Meridia	Obesity	Insomnia, palpitations, headache, dry mouth, nervousness, tachycardia, anorexia, dizziness, excitement	5–15 mg PO once daily

\*The term *generic* indicates the drug is available in generic form.

dyspnea, urinary retention, and variations in the heart rate. Administration of caffeine and sodium benzoate may result in tachycardia, palpitations, nausea, and vomiting.

One of the chief adverse reactions associated with the amphetamines and anorexiant is overstimulation of the CNS, which may result in a variety of adverse reactions, including insomnia, tachycardia, nervousness, headache, anorexia, dizziness, and excitement. In some instances, the intensity of these reactions is dose dependent, but some individuals may experience an intense degree of these symptoms even with low doses. Other individuals experience few symptoms of CNS stimulation.

#### Nursing Alert

*The amphetamines and anorexiant have abuse and addiction potential. Long-term use of amphetamines for obesity may result in tolerance to the drug and a tendency to increase the dose. Extreme psychological dependency may also occur.*

The amphetamines and anorexiant are recommended only for short-term use in selected patients for the treatment of exogenous obesity. When used for treatment of children with ADD, long-term use must be followed by gradual withdrawal of the drug.

### CONTRAINDICATIONS

The CNS stimulants are contraindicated in patients with known hypersensitivity or severe hypertension, in newborns, and in patients with epilepsy or convulsive

states, pneumothorax, acute bronchial asthma, head injury, or stroke. In addition, the amphetamines are contraindicated in patients with hyperthyroidism and glaucoma. The anorexiant are classified as Pregnancy Category X and should not be used during pregnancy.

### PRECAUTIONS

The CNS stimulants are given cautiously in all patients, particularly because the use of these drugs can lead to physical dependence. Some individuals are especially sensitive to the effects of the CNS stimulants. The analeptics and amphetamines are Pregnancy Category B drugs and are not recommended during pregnancy, except when clearly needed. These drugs are used with extreme caution in patients with cardiovascular disease and in women during the early stages of pregnancy.

### INTERACTIONS

The amphetamines and the anorexiant should not be given during or within 14 days after administration of monoamine oxidase inhibitors (see Chap. 31) because the patient may experience hypertensive crisis and intracranial hemorrhage. When guanethidine is administered with the amphetamines or the anorexiant, the antihypertensive effect of guanethidine may decrease. Coadministration of the amphetamines or the anorexiant with the tricyclic antidepressants may decrease the effects of the amphetamines or the anorexiant.

## NURSING PROCESS

## ● The Patient Receiving a Central Nervous System Stimulant

## ASSESSMENT

Assessment of the patient receiving a CNS stimulant depends on the drug, the patient, and the reason for administration.

**Preadministration Assessment**

The preadministration assessment depends on the type of CNS used and the reason for administration.

**ANALEPTICS.** When a CNS stimulant is prescribed for respiratory depression, initial patient assessments will include the blood pressure, pulse, and respiratory rate. It is important to note the depth of the respirations and any pattern to the respiratory rate, such as shallow respirations or alternating deep and shallow respirations. The nurse reviews recent laboratory tests (if any), such as arterial blood gas studies. Before administering the drug, the nurse ensures that the patient has a patent airway. Oxygen is usually administered before, during, and after drug administration.

**AMPHETAMINES.** When an amphetamine is prescribed for any reason, the nurse weighs the patient and takes the blood pressure, pulse, and respiratory rate before starting drug therapy.

The nurse should initially observe the child with ADD for the various patterns of abnormal behavior. The nurse records a summary of the behavior pattern in the patient's chart to provide a comparison with future changes that may occur during therapy.

**ANOREXIANTS.** When an anorexiant or amphetamine is used as part of the treatment of obesity, the drug is usually prescribed for outpatient use. The nurse obtains and records the blood pressure, pulse, respiratory rate, and weight before therapy is started.

**Ongoing Assessment**

The ongoing assessment depends on the type of CNS stimulant used and the reason for administration.

**ANALEPTICS.** After administration of an analeptic, the nurse carefully monitors the patient's respiratory rate and pattern until the respirations return to normal. The nurse monitors the level of consciousness, the blood pressure, and pulse rate at 5- to 15-minute intervals or as ordered by the primary health care provider. The nurse may draw blood for arterial blood gas analysis at intervals to determine the effectiveness of the analeptic, as well as the need for additional drug therapy. It is

important to observe the patient for adverse drug reactions and to report their occurrence immediately to the primary health care provider.

**ATTENTION DEFICIT DISORDER.** If the child is hospitalized, the nurse enters a daily summary of the child's behavior in the patient's record. This provides a record of the results of therapy.

**NARCOLEPSY.** The nurse observes the patient with narcolepsy during daytime hours. If periods of sleep are noted, the nurse records the time of day they occur and their length.

**WEIGHT LOSS.** When an amphetamine or anorexiant is prescribed for obesity, the nurse obtains the patient's weight and vital signs at the time of each outpatient visit.

## NURSING DIAGNOSES

Drug-specific nursing diagnoses are highlighted in the Nursing Diagnoses Checklist. Other nursing diagnoses applicable to these drugs are discussed in depth in Chapter 4.

## PLANNING

The expected outcomes for the patient depend on the reason for administration of a CNS stimulant but may include an optimal response to therapy, management of adverse drug reactions, and an understanding of the drug regimen.

## IMPLEMENTATION

**Promoting an Optimal Response to Therapy**

Respiratory depression can be a serious event requiring administration of a respiratory stimulant. When an analeptic is administered, the nurse notes and records the rate, depth, and character of the respirations before the drug is given to provide a database for evaluation of the effectiveness of drug therapy. Oxygen is usually ordered for before and after administration of a respiratory stimulant. After administration, the nurse monitors respirations closely and records the effects of therapy.

When a CNS stimulant such as dextroamphetamine is administered to treat a child with ADD, the drug regimen will be periodically interrupted to determine if the child still exhibits the symptoms of ADD.

## Nursing Diagnoses Checklist

- ✓ **Risk for Sleep Pattern Disturbance** related to hyperactivity, nervousness, insomnia, other (specify)
- ✓ **Risk for Injury** related to adverse drug effects (CNS stimulation, drug dependency, other [specify])



### Monitoring and Managing Adverse Drug Reactions

The adverse drug reactions that may occur with the use of an amphetamine, such as insomnia and a significant increase in blood pressure and pulse rate, may be serious enough to require discontinuation of the drug. In some instances, the adverse drug effects are mild and may even disappear during therapy. The nurse informs the primary care provider of all adverse reactions.

When use of the CNS stimulants causes insomnia, the nurse administers the drug early in the day (when possible) to diminish sleep disturbances. The patient is encouraged not to nap during the day. Other stimulants, such as coffee, tea, or cola drinks, are avoided. In some patients, nervousness, restlessness, and palpitations may occur. The vital signs are checked every 6 to 8 hours or more often if tachycardia, hypertension, or palpitations occur. Many times these adverse reactions will diminish with continued use as tolerance develops. If tolerance develops, the dosage is not increased.



#### Gerontologic Alert

*Older adults are especially sensitive to the effects of the CNS stimulants and may exhibit excessive anxiety, nervousness, insomnia, and mental confusion. Cardiovascular disorders, common in the older adult, may be worsened by the CNS stimulants. Careful monitoring is important because the presence of these reactions may result in the need to discontinue use of the drug.*

Nausea and vomiting may occur with the administration of an analeptic; therefore, the nurse should keep a suction machine nearby should vomiting occur. Urinary retention may be seen with the administration of doxapram; therefore, the nurse measures intake and output and notifies the primary health care provider if the patient is unable to void or the bladder appears distended on palpation.

Long-term treatment with the CNS stimulants can retard growth in children. Children on long-term treatment with the CNS drugs require frequent height and weight measurements to monitor growth. Intermittent therapy is usually advised to prevent tolerance to the drug and to minimize the effect on growth and the development of tolerance.

### Educating the Patient and Family

The nurse explains the therapeutic regimen and adverse drug reactions to the patient and family. The type of information included in the teaching plan will depend on the drug and the reason for its use. It is important to emphasize the importance of following the recom-

mended dosage schedule. The nurse may include the following additional teaching points:

- Attention deficit disorder: Give the drug in the morning 30 to 45 minutes before breakfast and before lunch. Do not give the drug in the afternoon. Pemoline is given once daily in the morning. Therapeutic response of pemoline may take 3 to 4 weeks. Insomnia and anorexia usually disappear during continued therapy. Write a daily summary of the child's behavior, including periods of hyperactivity, general pattern of behavior, socialization with others, and attention span. Bring this record to each primary health care provider or clinic visit because this record may help the primary health care provider determine future drug dosages or additional treatment modalities. The primary health care provider may prescribe that the drug be given only on school days when high levels of attention and performance are necessary.
- Narcolepsy: Keep a record of the number of times per day that periods of sleepiness occur, and bring this record to each visit to the primary health care provider or clinic.
- Amphetamines and anorexiant: These drugs are taken early in the day to avoid insomnia. Do not increase the dose or take the drug more frequently, except on the advice of a primary health care provider. These drugs may impair the ability to drive or perform hazardous tasks and may mask extreme fatigue. If dizziness, light-headedness, anxiety, nervousness, or tremors occur, contact the primary care provider. Avoid or decrease the use of coffee, tea, and carbonated beverages containing caffeine (see Patient and Family Teaching Checklist: Using Anorexiant for Weight Loss).
- Caffeine (oral, nonprescription): Avoid the use of oral caffeine-containing products to stay awake if there is a history of heart disease, high blood pressure, or stomach ulcers. These products are intended for occasional use and should not be used if heart palpitations, dizziness, or light-headedness occurs.

### EVALUATION

- The parent or child reports that the child's behavior and school performance are improved.
- The patient reports fewer episodes of inappropriate sleep patterns.
- Adverse reactions are identified and managed through appropriate nursing interventions.
- The patient complies with the prescribed drug regimen.
- The patient and family demonstrate an understanding of the drug regimen.
- The patient verbalizes the importance of complying with the prescribed therapeutic regimen.

### Patient and Family Teaching Checklist

#### Using Anorexiant for Weight Loss

##### The nurse:

- ✓ Reviews reasons for the drug and prescribed drug regimen, including drug name, dosage, and frequency of administration.
- ✓ Stresses the importance of taking the drug exactly as prescribed, including not to increase the dose or take more frequently unless instructed to do so by the prescriber.
- ✓ Reinforces use of drug for short-term therapy only.
- ✓ Warns about possible addiction, drug tolerance, and psychological dependency.
- ✓ Reviews possible adverse reactions, especially CNS overstimulation, with instructions to notify the health care provider immediately should any occur.
- ✓ Instructs to take drug early in day to minimize insomnia.
- ✓ Cautions about safety measures because of possible impairment in ability to drive or perform hazardous tasks.
- ✓ Advises to avoid other stimulants, including those containing caffeine such as coffee, tea, and cola drinks; provides a written list of foods to avoid.
- ✓ Urges to read labels of foods and nonprescription drugs for possible stimulant content.
- ✓ Reinforces prescribed dietary and exercise program for weight reduction, both verbally and in writing.
- ✓ Reassures that results of therapy will be monitored by continued follow-up visits with health care provider.
- ✓ Arranges for follow-up visits as necessary.

### ● Critical Thinking Exercises

1. Ms. Stone is given a special diet and prescribed an anorexiant to help her lose 20 lb before she has reconstructive knee surgery. Determine what instructions you would include in a teaching plan for this patient.
2. Mr. Trent has narcolepsy and is prescribed amphetamine 10 mg/d. Develop questions you would ask Mr. Trent when he returns to the clinic for evaluation after 1 month of therapy.
3. Ms. Allison is prescribed an analeptic for respiratory depression. Discuss what preadministration and ongoing assessments you would make when caring for Ms. Allison.
4. Discuss precautions that should be taken when administering the CNS stimulants.

### ● Review Questions

1. Initial assessment of the child with attention deficit disorder includes \_\_\_\_\_.
  - A. assessing to which stimuli the child responds the most
  - B. determining the child's intelligence
  - C. obtaining a summary of the child's behavior pattern
  - D. obtaining vital signs
2. When assessing the patient receiving doxapram for chronic pulmonary disease, the nurse observes the patient for adverse drug reactions, which may include \_\_\_\_\_.
  - A. headache, dizziness, variations in heart rate
  - B. diarrhea, drowsiness, hypotension
  - C. decreased respiratory rate, weight gain, bradycardia
  - D. fever, dysuria, constipation
3. When teaching a patient with narcolepsy who is receiving an amphetamine, the nurse instructs the patient to \_\_\_\_\_.
  - A. record the times of the day the medication is taken
  - B. take the medication at bedtime as well as in the morning
  - C. take the drug with meals
  - D. keep a record of how often periods of sleepiness occur
4. When administering an amphetamine, the nurse first checks to see if the patient is taking or has taken an monoamine oxidase (MAO) inhibitor because \_\_\_\_\_.
  - A. a lower dosage of the amphetamine may be needed
  - B. a higher dosage of the amphetamine may be needed
  - C. if the amphetamine is administered within 14 days of the MAO inhibitor, cardiac arrest may occur
  - D. if the amphetamine is administered within 14 days of the MAO inhibitor, an intracranial hemorrhage may occur

### ● Medication Dosage Problems

1. Phentermine hydrochloride 8 mg three times a day PO is prescribed as an adjunct for weight loss. The total amount of drug the patient will receive daily is \_\_\_\_\_. Is this an appropriate dose for this drug? \_\_\_\_\_
2. Modafinil 400 mg is prescribed. The drug is available in 200-mg tablets. The nurse administers \_\_\_\_\_.