Chapter 6: Adrenergic (Sympathomimetic) Bronchodilators

MULTIPLE CHOICE

1. Adrenergic bronchodilators mimic the actions of:

a. Norepinephrine  
b. Acetylcholine  
c. Penicillin  
d. Epinephrine

ANS: D

Penicillin is an antibiotic, not a bronchodilator. All adrenergic (sympathomimetic) bronchodilators are either catecholamines or derivatives of catecholamines. Catecholamines, or sympathomimetic amines, mimic the actions of epinephrine more or less precisely, causing tachycardia, elevated blood pressure, smooth muscle relaxation of bronchioles and skeletal muscle blood vessels, glycogenolysis, skeletal muscle tremor, and central nervous system stimulation.

REF: pgs. 98-99 OBJ: 2 LEVEL: Recall

MSC: Chapter 6 Adrenergic (Sympathomimetic) Bronchodilators
2. Relaxation of smooth airway muscle in the presence of reversible airflow obstruction is a general indication for the use of:

a. Mucolytics
b. Adrenergic bronchodilators
c. Antiinfective agents
d. Steroids

ANS: B

Short-acting b₂ agonists such as albuterol, levalbuterol, and pirbuterol are indicated for relief of acute reversible airflow obstruction in asthma or other obstructive airway diseases. Although mucolytics may help reduce the increased mucus production associated with complicated asthma, they do not reverse bronchoconstriction. Antiinfective agents help fight bacterial or viral infections, but they do not reverse airflow obstruction. Steroids help fight the inflammation associated with asthma; however, they are not fast-acting and cannot reverse airflow obstruction associated with bronchoconstriction.

REF: pg. 97 OBJ: 3 LEVEL: Recall

MSC: Chapter 6 Adrenergic (Sympathomimetic) Bronchodilators

3. Disease states that could benefit from the use of adrenergic bronchodilators include which of the following?

4. Asthma
5. Bronchitis
6. Emphysema
7. Bronchiectasis
8. Pleural effusion

a. 1 and 3 only
b. 2, 4, and 5 only
c. 1, 2, 3, and 4 only
d. 1, 2, 3, 4, and 5
ANS: C

Adrenergic bronchodilators would not reverse a pleural effusion. The general indication for use of an adrenergic bronchodilator is relaxation of airway smooth muscle in the presence of reversible airflow obstruction associated with acute and chronic asthma (including exercise-induced asthma), bronchitis, emphysema, bronchiectasis, and other obstructive airway diseases.

REF: pg. 97 OBJ: 3 LEVEL: Recall
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4. Short-acting b2 agonists are indicated for:
   a. Reduction of airway edema
   b. Relief of acute reversible airflow obstruction
   c. Maintenance of bronchodilation
   d. Thinning of secretions

ANS: B

Steroids, not b agonists, are useful in reducing airway swelling. Short-acting b2 agonists such as albuterol, levalbuterol, and pirbuterol are indicated for relief of acute reversible airflow obstruction in asthma or other obstructive airway diseases. Long-acting b agonists are used for maintenance bronchodilation. b agonists are not mucus-controlling agents.

REF: pg. 97 OBJ: 3 LEVEL: Recall
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5. Your patient is diagnosed with persistent asthma. Which type of drug would you recommend for maintenance bronchodilation and control of bronchospasm?
a. Short-acting adrenergic agent
b. Long-acting adrenergic agent
c. a-adrenergic agent
d. Mucolytic agent

ANS: B

Short-acting adrenergics are effective rescue medications, but they do not provide the long-term relief needed with the nocturnal symptoms often associated with persistent asthma. Long-acting agents, such as salmeterol, formoterol, and arformoterol are indicated for maintenance bronchodilation and control of bronchospasm and nocturnal symptoms in asthma or other obstructive diseases. Adrenergic agents that are a-specific may not provide the b-specific bronchodilation necessary in the control of persistent asthma. Mucolytics do not produce bronchodilation; many may actually cause bronchoconstriction as a side effect. The topic of corticosteroids has not yet been discussed. The best answer from the given choices is long-acting adrenergic agents. The question is trying to ensure the understanding of the difference in “rescue” medications and “maintenance” medications.

REF: pg. 97 OBJ: 5 LEVEL: Recall

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6. Your patient presents with postextubation stridor. You recommend racemic epinephrine for its:

a. a-adrenergic vasoconstricting effect
b. Short-acting b2-adrenergic effect
c. Long-acting b2-adrenergic effect
d. b1-adrenergic effect

ANS: A
Racemic epinephrine is often used via either inhaled aerosol or direct lung instillation for its strong a-adrenergic vasoconstricting effect, to reduce airway swelling after extubation or during epiglottitis, croup, or bronchiolitis or to control airway bleeding during endoscopy. This effect would provide short-term bronchodilation, but little or no relief from airway edema. The a-adrenergic vasoconstrictive response would slow the progress of airway edema.

REF: pg. 97 OBJ: 5 LEVEL: Recall

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7. You enter the room of a 2-year-old patient who presents with the characteristic “barking cough” found with croup. Once the diagnosis is confirmed, which of the following medications could you recommend to help provide relief from subglottic swelling?

a. Albuterol
b. Terbutaline
c. Racemic epinephrine
d. Salmeterol

ANS: C

Although an effective bronchodilator, albuterol provides little or no relief from airway swelling. Terbutaline would not produce the necessary a-adrenergic vasoconstricting effect. Racemic epinephrine is often used via either inhaled aerosol or direct lung instillation for its strong a-adrenergic vasoconstricting effect, to reduce airway swelling after extubation or during epiglottitis, croup, or bronchiolitis or to control airway bleeding during endoscopy. Salmeterol is a long-acting bronchodilator.

REF: pg. 97 OBJ: 8 LEVEL: Application

MSC: Chapter 6 Adrenergic (Sympathomimetic) Bronchodilators
8. In a patient who is receiving large doses of catecholamines, which side effect would you expect to see?

a. Decrease in blood pressure  
b. Constriction of bronchial smooth muscle  
c. Diuresis  
d. Bradycardia

ANS: C

Catecholamines, or sympathomimetic amines, mimic the actions of epinephrine more or less precisely, causing tachycardia, elevated blood pressure, smooth muscle relaxation of bronchioles and skeletal muscle blood vessels, glycogenolysis, skeletal muscle tremor, and central nervous system stimulation.

REF: pgs. 98-99   OBJ: 7 LEVEL: Application  
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9. Levalbuterol is:

a. The same as albuterol  
b. The single (R)-isomer of albuterol  
c. An equal mixture of (R)-isomers and (S)-isomers  
d. The same as racemic epinephrine

ANS: B

Albuterol is a racemic mixture, denoted by (R)-isomers and (S)-isomers. Levalbuterol, released in 1999, is the first synthetic inhaled solution available as the single (R)-isomer of racemic albuterol, not a racemic form of epinephrine.
10. Epinephrine stimulates which sites?
   11. a
   12. b₁
   13. b₂
   14. Cholinergic

   a. 2 only
   b. 4 only
   c. 1, 2, and 3 only
   d. 2, 3, and 4 only

ANS: C

Epinephrine is a potent catecholamine bronchodilator that stimulates both a and b receptors. Because epinephrine lacks b₂-receptor specificity, side effects such as tachycardia, blood pressure increase, tremor, headache, and insomnia are prevalent.

11. Epinephrine would not be indicated for:

   a. Treatment of infections
   b. Systemic hypersensitivity reactions
   c. Acute asthma episodes
   d. Cardiac stimulation
Epinephrine occurs naturally in the adrenal medulla and has a rapid onset but a short duration because of metabolism by catechol O-methyltransferase (COMT). It is used both by inhalation and subcutaneously to treat patients with acute asthmatic episodes. It is also used as a cardiac stimulant, based on its strong $b_1$ effects. Self-administered intramuscular injectable doses of 0.3 mg and 0.15 mg are marketed to control systemic hypersensitivity (anaphylactoid) reactions.

ANS: A

REF: pg. 99 OBJ: 7 LEVEL: Recall

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12. Racemic epinephrine comes in what percent solution?

a. 0.05%

b. 1.25%

c. 2.25%

d. 5.0%

ANS: C

Because only the (R)-isomer is active on adrenergic receptors, a 1:100 strength formulation of natural epinephrine (injectable formulation) is used for nebulization, whereas a 2.25% strength racemic mixture is used in nebulization.

REF: pg. 99 OBJ: 6 LEVEL: Recall

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13. The keyhole theory indicates that the larger the side-chain attachment to a catechol base, the:

a. Shorter the duration of action  
b. More easily it is metabolized  
c. More easily it is broken down by catechol O-methyltransferase (COMT)  
d. Greater the b₂ specificity

ANS: D

Duration of action is not affected by the side-chain attachment. All catecholamines are rapidly inactivated by COMT. Duration of action of all catecholamines is readily limited by COMT. The theory that explains the shift from a activity to b₂ specificity has been termed the keyhole theory of b sympathomimetic receptors: The larger the side-chain attachment to a catechol base, the greater is the b₂ specificity. If the catecholamine structural pattern is seen as a keyhole shape, the larger the “key” (side chain), the more b₂ specific is the drug.

REF: pg. 99 OBJ: 5 LEVEL: Recall

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14. Catecholamines are inactivated by:

a. ACTH  
b. COMT  
c. Epinephrine  
d. ATP

ANS: B

Adrenocorticotropic hormone (ACTH) is not associated with catecholamines. Despite the increase in b₂ specificity with increased side-chain bulk, all catecholamines are rapidly
inactivated by the cytoplasmic enzyme catechol O-methyltransferase (COMT). This enzyme is found in the liver and kidneys as well as throughout the rest of the body. Epinephrine is a catecholamine. Adenosine triphosphate (ATP) is used in the production of energy within a cell.

REF: pg. 100 OBJ: 5 LEVEL: Recall

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15. Catecholamines should not be given by which of the following routes?

a. Inhalation
b. Subcutaneous
c. Oral
d. Injection

ANS: C

Catecholamines are unsuitable for oral administration because they are inactivated in the gut and liver by conjugation with sulfate or glucuronide at the carbon-4 site. Because of this action, they have no effect when taken by mouth, limiting their route of administration to inhalation or injection.

REF: pg. 100 OBJ: 6 LEVEL: Recall

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16. Albuterol is available in which of the following forms?
17. Syrup
18. Nebulizer solution
19. Metered dose inhaler (MDI)
20. Oral tablets
21. Dry powder inhaler (DPI) capsules
ANS: D

Albuterol is available in various pharmaceutical vehicles in the United States, including oral tablets, syrup, nebulizer solution, MDI, and extended-release tablets.

REF: pg. 101 OBJ: 4 LEVEL: Recall

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17. Salmeterol is:

a. A long-acting β-adrenergic agent
b. Another name for albuterol
c. Available in nebulizer solution only
d. Indicated for acute asthma attacks

ANS: A

Salmeterol, a β2-selective receptor agonist, is available in a dry powder formulation in the Diskus® inhaler. The effects of salmeterol may last 12 hours or more. Albuterol and salmeterol are different drugs with different bronchodilating profiles. The onset of action for salmeterol is between 14 minutes and 22 minutes, rendering it unacceptable as a rescue-type medication.

REF: pg. 104 OBJ: 3 LEVEL: Recall
18. Long-acting $\beta_2$ agonists are indicated for:

a. Acute asthma attacks  
b. Mucus reduction  
c. Treating infections  
d. Maintenance therapy for asthmatics

ANS: D

The onset of action of many long-acting bronchodilators makes them unsuitable as a rescue medication. $\beta_2$ agonists are used mostly for their bronchodilatory effects and are not antiinfective agents. Although $\beta_2$ agonists exert some stimulation of mucociliary clearance, they do not reduce mucus production. Long-acting bronchodilators are useful in controlling nocturnal symptoms and provide a more convenient dosing schedule. The topic of corticosteroids has not yet been discussed. The best answer from the given choices is long-acting adrenergic agents. The question is trying to ensure the understanding of the difference in “rescue” medications and “maintenance” medications.

REF: pg. 97 OBJ: 8 LEVEL: Application

19. The bronchodilating action of adrenergic drugs is due to stimulation of:

a. $\alpha$ receptors  
b. Cholinergic receptors  
c. $\beta_1$ receptors  
d. $\beta_2$ receptors
a-receptor stimulation has a vasoconstriction and vasopressor effect. Stimulation of cholinergic receptors may cause bronchoconstriction. b₁ stimulation increases myocardial conductivity, heart rate, and contractile force. The bronchodilating action of the adrenergic drugs is due to stimulation of b₂ receptors located on bronchial smooth muscle.

ANS: D

b₁-receptor stimulation increases myocardial conductivity, heart rate, and contractile force. The bronchodilating action of the adrenergic drugs is due to stimulation of b₂ receptors located on bronchial smooth muscle.

ANS: C

Smooth muscle relaxation most likely occurs as a result of:

a. A decrease in intracellular cAMP
b. An increase in intracellular cAMP

c. An increase in ATP

d. A decrease in ATP

ANS: B

Activation of adenylyl cyclase by the Gs protein causes an increased synthesis of the second messenger, cyclic adenosine 3',5'-monophosphate (cAMP). An increase in cAMP may lead to smooth muscle relaxation by increasing the inactivation of myosin light chain kinase, an enzyme initiating myosin-actin interaction and subsequent smooth muscle contraction. An increase in cAMP also leads to a decrease in intracellular calcium. ATP is used for cellular energy production.

REF: pg. 107 OBJ: 5 LEVEL: Recall

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22. Inhalation is the preferred route of administering catecholamines for which of the following reasons?
   23. Rapid onset of action
   24. Smaller dosage used
   25. Reduced side effects
   26. Drug delivered to target organ
   27. Safe and painless route

a. 1 and 2 only
b. 3 and 4 only
c. 1, 3, and 5 only
d. 1, 2, 3, 4, and 5

ANS: D
Inhalation is the preferred route for administering β-adrenergic drugs for all the following reasons:

1. Onset is rapid.
2. Smaller doses are needed compared with oral doses.
3. Side effects such as tremor and tachycardia are reduced.
4. Drugs are delivered directly to the target organ (i.e., lung).
5. Inhalation is painless and safe.

REF: pg. 98 OBJ: 6 LEVEL: Recall

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23. Continuous nebulization of inhaled β agonists has been used for:

a. Severe asthma
b. Pneumonia
c. Cystic fibrosis
d. Emphysema

ANS: A

The administration of inhaled adrenergic agents by continuous nebulization has been used for management of severe asthma, in an effort to avoid respiratory failure, intubation, and mechanical ventilation. The Guidelines for the Diagnosis and Management of Asthma released by the 1997 National Asthma Education and Prevention Expert Panel Report 2 (NAEPP EPR 2) also recommend 2.5 to 5 mg of albuterol by nebulizer every 20 minutes for three doses and 10 to 15 mg/hr by continuous nebulization. Because a nebulizer treatment takes approximately 10 minutes, giving three treatments every 20 minutes requires repeated therapist attendance. Continuous administration by nebulizer may simplify such frequent treatments. Pneumonia is an interstitial process, and unless there is a bronchoconstrictive component to the disease, a β agonist would be of little use. Cystic fibrosis is a chronic disease, and although a β agonist may be useful to reverse any accompanying bronchoconstriction, its use as a continually nebulized medication is unwarranted. Similar to cystic fibrosis, emphysema is a chronic disease process, and unless the patient is having an acute episode accompanied by bronchoconstriction, continuous nebulization would be unwarranted.
24. The dosage recommended by NAEPP EPR 2 for continuous nebulization of adrenergic agents is:
   a. 5 to 8 mg/hr  
   b. 8 to 12 mg/hr  
   c. 10 to 15 mg/hr  
   d. 20 to 30 mg/hr

ANS: C

The *Guidelines for the Diagnosis and Management of Asthma* released by the 1997 National Asthma Education and Prevention Expert Panel Report 2 (NAEPP EPR 2) recommend 2.5 to 5 mg of albuterol by nebulizer every 20 minutes for three doses and 10 to 15 mg/hr by continuous nebulization.

25. Your patient is receiving her third continuous nebulizer of albuterol (15 mg/hr). Which potential complications should you be on the lookout for?
   26. Hypokalemia  
   27. Cardiac arrhythmias  
   28. Hyperglycemia  
   29. Premature ventricular contractions  
   30. Tremor

   a. 2 and 4 only  
   b. 1, 2, and 5 only
c. 1, 2, 4, and 5 only

d. 1, 2, 3, 4, and 5

ANS: D

Potential complications include cardiac arrhythmias, hypokalemia, and hyperglycemia. Unifocal premature ventricular contractions have been reported, and significant tremors may occur. Subsensitivity to continuous therapy has not been observed. Close monitoring of patients receiving continuous \( \beta \) agonists is necessary and includes observation and cardiac and electrolyte monitoring. Selective \( \beta_2 \) agonists, such as albuterol, should be used to reduce side effects.

REF: pg. 111  OBJ: 7 LEVEL: Application

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26. When monitoring a patient using a sympathomimetic aerosol, which side effect would you expect to see?

a. Sleepiness
b. Muscle tremor
c. Bradycardia
d. Hypotension

ANS: C

Side effects of sympathomimetic drugs include insomnia, muscle tremor, and tachycardia. Bradycardia and hypotension would be a result of parasympathetic stimulation.

REF: pg. 110  OBJ: 7 LEVEL: Application

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27. You are ordered to extubate a mechanically ventilated patient who has recently undergone open heart surgery. On postextubation assessment you note that the patient has stridor with mild retractions. What type of pharmacologic agent would you recommend?

   a. $\beta_2$ adrenergic
   b. $\alpha$ adrenergic
   c. Anticholinergic
   d. Sympatholytic

ANS: B

The $\alpha$-adrenergic vasoconstricting effect of racemic epinephrine reduces swelling in the airway.

REF: pg. 97 OBJ: 8 LEVEL: Application

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28. What is the only $\beta$-agonist formulation that is a single isomer and is approved by the U.S. Food and Drug Administration (FDA) for aerosol delivery?

   a. Epinephrine
   b. Albuterol
   c. Levalbuterol
   d. Tiotropium

ANS: C

Although epinephrine and albuterol have $\beta$-agonist effects, they are both racemic mixtures. Tiotropium is a parasympathomimetic drug. Levalbuterol is the only FDA-approved single-isomer formulation of a $\beta$-agonist drug.
29. What is the rationale for using the single-isomer agent levalbuterol instead of racemic albuterol?

a. The (S)-isomer is thought to promote bronchoconstriction.
b. The (S)-isomer is a weak bronchodilator.
c. The (R)-isomer is thought to cause tachycardia.
d. The (R)-isomer is thought to cause tremors.

ANS: A

Although the (S)-isomer is not active on adrenergic receptors, it may not be altogether inactive. Several effects of the (S)-isomer may promote bronchoconstriction.

30. What is the main difference between salmeterol and formoterol?

a. Formoterol is short-acting, and salmeterol is long-acting.
b. Formoterol has a slower onset and peak effect compared with salmeterol.
c. Formoterol is more $b_2$-specific than salmeterol.
d. Formoterol has a quicker onset and peak effect than salmeterol.
Both salmeterol and formoterol are considered long-acting bronchodilators; however, the time to effect of formoterol is considered to be 2 to 3 minutes, whereas the time to effect of salmeterol is approximately 10 minutes.

31. What is the indication for use of a short-acting β agonist in asthma?

a. As maintenance therapy in reversible airflow obstruction
b. As rescue therapy in reversible airflow obstruction
c. As an antiinflammatory agent in reversible airflow obstruction
d. As an antiinfective agent in respiratory infections

ANS: B

Short-acting β agonists are used to treat acute reversible airflow obstruction by inducing bronchodilation. They were given the name “rescue medications” in the *Guidelines for the Diagnosis and Management of Asthma* released by the 1997 National Asthma Education and Prevention Expert Panel Report 2 (NAEPP EPR 2).

32. Is it appropriate to use formoterol as a rescue β-agonist bronchodilator?

a. Yes
b. No
The slower peak effect and prolonged activity of formoterol make it a better choice as a maintenance drug than as a rescue agent.

33. Which procedure would tell you that a patient has reversible airway obstruction?

a. Inspection—patient is short of breath when walking less than 25 ft
b. Pulmonary function tests before and after bronchodilator therapy
c. Pulse oximetry
d. Wheezing on auscultation

ANS: B

Inspection, auscultation, and pulse oximetry would be of little value if the patient is not having an attack. Only pulmonary function tests (along with a methylcholine challenge, if necessary) before and after bronchodilator therapy would provide enough information for a diagnosis.

34. You receive an order to administer 5 ml of albuterol by small volume nebulizer (SVN). You would:
a. Confirm the order on the chart and administer as directed
b. Have your supervisor administer the treatment
c. Call the physician to confirm the medication dose
d. Give 0.5 ml of medication because that is probably what the physician meant to write

ANS: C

The normal adult dose of albuterol is 2.5 mg, or 0.5 ml of concentrated drug. The order as written calls for 10 times the normal amount of active drug, and should be questioned.

REF: pg. 110 OBJ: 8 LEVEL: Application

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35. You are administering an aerosolized bronchodilator to your patient. Her pretreatment pulse was 85 beats/min. You would stop the treatment if her pulse reached:

a. 90 beats/min
b. 100 beats/min
c. 110 beats/min
d. 120 beats/min

ANS: C

If the patient’s heart rate increases by greater than 20% from its pretreatment rate, stopping the treatment may be warranted.

REF: pg. 112 OBJ: 7 LEVEL: Application
36. A 7-year-old boy has been given multiple aerosolized albuterol treatments over the last several days. His father tells you that every time a respiratory therapist administers a treatment, a few minutes later the saturation falls. You explain to the father:

a. That this is abnormal and call the physician  
b. That this is abnormal and you will try to change the medication to levalbuterol  
c. That this is normal because of increased perfusion to poorly ventilated areas  
d. That this is normal because you are giving the treatment with air

ANS: C

A decrease in arterial oxygen pressure (PaO₂) has been noted with β agonist administration during bronchospasm and is probably due to an increase in perfusion to poorly ventilated areas of the lung.

REF: pg. 114 OBJ: 7 LEVEL: Application
Racemic epinephrine is indicated for postextubation swelling of the airway because of its strong α-adrenergic vasoconstricting effect.

REF: pg. 97 OBJ: 8 LEVEL: Application

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38. Metaproterenol can be taken orally because:
   a. It has a fast peak time, about 3 to 5 minutes.
   b. It does not contain chlorofluorocarbons (CFCs).
   c. It is an antibiotic.
   d. It resists inactivation by catechol O-methyltransferase (COMT).

ANS: D

Because metaproterenol is not inactivated by COMT, it has a significantly longer duration of action of 4 to 6 hours compared with the short-acting catecholamine bronchodilators. Metaproterenol can be taken orally because it resists inactivation by sulfatase enzymes in the gastrointestinal tract and liver. Metaproterenol is slower to reach a peak effect (30 to 60 minutes) than epinephrine. The CFC version of metaproterenol was removed from the market on June 14, 2010.

REF: pg. 100 OBJ: 6 LEVEL: Recall

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39. A drug that exhibits its pharmacologic activity once it is converted inside the body to its active form is called:
   a. The asthma paradox
   b. A prodrug
   c. Downregulation
d. A sympathomimetic

ANS: B

_Asthma paradox_ refers to the increasing incidence of asthma morbidity and especially asthma mortality despite advances in the understanding of asthma and availability of improved drugs to treat asthma.

_Prodrug_ refers to a drug that exhibits its pharmacologic activity once it is converted inside the body to its active form.

_Downregulation_ refers to long-term desensitization of b receptors to b_2_ agonists, caused by a reduction in the number of b receptors.

_Sympathomimetic_ refers to producing effects similar to the effects of the sympathetic nervous system.

REF: pg. 101 OBJ: 5 LEVEL: Recall

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40. Because of their antiinflammatory effects, short-acting and long-acting b agonists can be a substitute for inhaled corticosteroids.

a. True
b. False
c. Only when substituting antiinflammatory medications
d. Only when given as a rescue medication

ANS: B

Long-acting b_2_ agonists are not recommended for rescue bronchodilation because repeated administration with their longer duration and increased lipophilic property risk accumulation and
toxicity. Although they have antiinflammatory effects, short-acting or long-acting \( b \) agonists are not a substitute for inhaled corticosteroids in asthma maintenance or for other antiinflammatory medications if such are required.

**REF:** pg. 106 **OBJ:** 5 **LEVEL:** Recall

**MSC:** Chapter 6 Adrenergic (Sympathomimetic) Bronchodilators

41. The dosage and route for terbutaline is:

a. 5 to 8 mg PO  
b. 8 to 12 mg via nebulization  
c. 0.25 mg SQ  
d. 0.3 mg SQ

**ANS:** C

Terbutaline 0.25 mg (0.25 ml of a 1-mg/ml solution) repeated in 15 to 30 minutes, not exceeding 0.5 mg in 4 hours, is administered subcutaneously (SQ).

**REF:** pg. 111 **OBJ:** 6 **LEVEL:** Application

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**MATCHING**

*Match the appropriate generic drug name to the correct trade name.*

a. Formoterol  
b. Salmeterol  
c. Racemic epinephrine
d. Pirbuterol
e. Arformoterol

1. Brovana®

2. Foradil®

3. microNefrin®

4. Serevent Diskus®

5. Maxair®

1. ANS: E  REF:  pg. 98  OBJ: 3 LEVEL: Recall
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2. ANS: A  REF:  pg. 98  OBJ: 3 LEVEL: Recall
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3. ANS: C  REF:  pg. 98  OBJ: 3 LEVEL: Recall
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4. ANS: B  REF:  pg. 98  OBJ: 3 LEVEL: Recall
Match the appropriate medication to the subgroup of adrenergic bronchodilators based on the differences in duration of action. Choices can be used more than once.

a. Ultrashort-acting
b. Short-acting
c. Long-acting

6. Racemic epinephrine

7. Salmeterol

8. Formoterol

9. Albuterol

10. Pirbuterol

11. Arformoterol
12. Levalbuterol

13. Metaproterenol

14. Epinephrine

6. ANS: A  
REF: pg. 98  
OBJ: 4 LEVEL: Recall
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7. ANS: C  
REF: pg. 98  
OBJ: 4 LEVEL: Recall
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8. ANS: C  
REF: pg. 98  
OBJ: 4 LEVEL: Recall
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9. ANS: B  
REF: pg. 98  
OBJ: 4 LEVEL: Recall
MSC: Chapter 6 Adrenergic (Sympathomimetic) Bronchodilators

10. ANS: B  
REF: pg. 98  
OBJ: 4 LEVEL: Recall
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11. ANS: C  
REF: pg. 98  
OBJ: 4 LEVEL: Recall
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12. ANS: B          REF: pg. 98          OBJ: 4 LEVEL: Recall
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13. ANS: B          REF: pg. 98          OBJ: 4 LEVEL: Recall
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14. ANS: A          REF: pg. 98          OBJ: 4 LEVEL: Recall
MSC: Chapter 6 Adrenergic (Sympathomimetic) Bronchodilators