LESSON ASSIGNMENT

SUBCOURSE MD0806  Therapeutics III.

LESSON 4  Vasodilatory Drugs.

LESSON ASSIGNMENT  Paragraphs 4-1--4-5.

LESSON OBJECTIVES  After completing this lesson you will be able to:

4-1.  Given one of the following terms: vasodilator, orthostatic hypotension, angina pectoris, arteriosclerosis, antherosclerosis, or peripheral vascular disease and a group of statements, select the statement that best defines the given term.

4-2.  Given the trade or generic name of a vasodilator and a list of trade and/or generic names of drugs, select the trade or generic name that corresponds to the given trade or generic name.

4-3.  Given the trade or generic name of a vasodilator and a list of indications, uses, side effects, patient precautionary statements, or dispensing statements, select the indication(s), use(s), side effect(s), patient precautionary statement(s), or dispensing statement for the given drug name.

SUGGESTION  After studying the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.
4-1. INTRODUCTION

Visualize a man walking down a hallway. He pauses at the foot of a stairway. From his pocket, he takes a small bottle containing some very small white tablets and he places one of these tablets under his tongue. After waiting a few seconds, he proceeds up the stairs. What was this scene? It was a man preparing his body—especially his heart—for the extra work required for walking up the stairs. This man, suffering from a condition called angina pectoris, used one of the vasodilators that will be discussed in this subcourse lesson. Without this drug, he would be unable to perform many of the energy expending tasks required for everyday life. In this lesson, you will be given the opportunity to broaden your background in some cardiovascular diseases as well as learn more about various vasodilators.

4-2. IMPORTANT TERMS AND THEIR DEFINITIONS

You have already been introduced to some of the terms below in another lesson in this subcourse. Some of the terms below might be new to you. In any event, each term applies to vasodilator agents.

a. Vasodilator. A vasodilator is a drug that dilates blood vessels with a resultant increase in blood flow.

b. Orthostatic Hypotension. Orthostatic hypotension is a condition characterized by fainting or dizziness because of inadequate blood supply to the brain because the blood has been pooled elsewhere in the body. Vasodilator agents may cause this condition. You may have experienced this condition before. Have you ever arisen quickly from a lying position to find that you are light-headed and dizzy? This is orthostatic hypotension.

c. Angina Pectoris. Angina pectoris is a condition manifested by excruciating chest pain sometimes radiating down the left arm. The pain probably arises from ischemia (lack of oxygen) in the heart caused by the increased demand for or decreased supply of oxygen.

d. Arteriosclerosis. Arteriosclerosis is characterized by thickening, hardening, and loss of elasticity of the walls of blood vessels.

e. Atherosclerosis. Atherosclerosis is a form of arteriosclerosis characterized by localized accumulation of lipids (fats), leading to a narrowing of the arteries and possible occlusion (blockage) of the vessels.
Peripheral Vascular Disease. Peripheral vascular disease (PVD) is a condition characterized by a narrowing or occlusion of peripheral arterioles leading to limited circulation to the extremities such as toes, fingers, and shoulders. You have probably seen elderly patients who wear extra clothing during hot weather. The cold feeling they have, even in hot weather, is probably due to lack of adequate circulation.

Section II. VASODILATOR DRUGS

4-3. INTRODUCTION

Now that you have some background in some cardiovascular disease, you will review some general categories of vasodilators and some of the specific agents that belong to each group.

4-4. SMOOTH MUSCLE RELAXANT VASODILATORS

Although the agents in this category affect almost all smooth muscle, our concern here is only with their relaxant effect upon the smooth muscle of the coronary vessels as well as peripheral (to the heart) blood vessels.

a. Amyl Nitrite. Amyl nitrite is a vasodilator administered only by inhalation. It is rapidly absorbed from the lungs. This product is supplied in perles (like many ammonia inhalants). When a person suffering from angina pectoris feels an attack about to occur, he will crush an amyl nitrite perle and inhale its vapors. The attack of angina pectoris is warded off or aborted in from one to two minutes. Because amyl nitrite perles may explode when stored above normal room temperature, it is very difficult for the patient to carry them in his pocket. This adverse situation normally prohibits their use in the treatment of angina pectoris. The side effects associated with amyl nitrite are usually attributed to the relaxation of all smooth muscle causing vasodilation. Headache and dizziness are very common side effects associated with amyl nitrite. Amyl nitrite does have an additional use, which is the treatment of cyanide poisoning.

b. Glyceryl Trinitrate (Nitroglycerin). Glyceryl trinitrate is the most common smooth muscle relaxant vasodilator used in the treatment of acute angina pectoris. This drug is the product described in the introductory remarks of this subcourse lesson when the man placed the small tablet under his tongue. Sublingual nitroglycerin tablets may be used to allow a person who has angina to do extra work or to alleviate an acute angina attack. Nitroglycerin’s sublingual onset of action is from 1 to 3 minutes with duration of action of from 9 to 11 minutes. Side effects associated with this drug include headache, dizziness, and orthostatic hypotension. The vasodilating effect of the drug may be so sudden that circulating blood pools in vascular (vessel) beds. This may cause the patient to become unconscious because of a lack of blood to the brain. Falling to the floor in a faint allows the immediate return of that blood flow to the brain and consciousness returns. Besides the sublingual form of nitroglycerin, sustained
release capsules (Nitro-Bid Plateau Caps®) with 5 to 20 milligrams of drug taken daily in divided doses, topical ointments (Nitrol®, Nitro-Bid®), and transdermal patches (Nitro-Dur®) are available. The ointment is applied using special paper every 6 hours. The transdermal system patches are applied to the chest wall each morning and removed after 12 hours. The patches offer the advantage of once daily dosing and less side effects for the patient. Each of these dosage forms is used for the prevention of angina attacks. Nitroglycerin sublingual tablets are volatile. They will lose their potency quickly when they are incorrectly stored. Therefore, the tablets must be dispensed in their original container (light-resistant container). The patient should also be instructed not to remove the tablets from the original glass container (that is, to place the tablets in a fancy pillbox). Federal law requires that all nitroglycerin products should be dispensed in their original containers (that is, glass, light resistant, and not child-resistant packaging). Another problem area with the nitroglycerin prescription is the dose. Normally physicians prescribe them in grains using 1/100 grain, 1/150 grain, or 1/200-grain tablets. You should be able to convert these to micrograms or milligrams. Intravenous nitroglycerin is used in patients that present with unstable angina (persisting chest pain) or possible myocardial infarction. The physician normally orders the nitroglycerin as a drip (mcg/min) and titrates (adjusts) the dose to pain relief.

c. **Isosorbide Dinitrate (Isordil® Sorbitrate®).** Isosorbide dinitrate is thought to be effective in the prophylactic treatment of angina pectoris, as well as the treatment of acute angina attacks. The side effects associated with this drug are headache and dizziness. Isordil® is supplied in many different dosage forms to include sublingual, chewable, compressed, and sustained action tablets and capsules (Tembids®). The sublingual tablets are used in the acute angina attacks in a dose of from 2.5 to 10 milligrams. The usual oral dose is from 15 to 80 milligrams daily in divided doses. These products should be dispensed in their original containers. Isosorbide mononitrate (Ismo®, Imdur®) is another product often prescribed.

**NOTE:** Tolerance develops to nitrate products. For the agents to maintain effectiveness, the patient must have a “nitrate-free” interval as part of the dosing regimen. Nitroglycerin patches are generally applied in the morning and removed in the evening (12 hours on and 12 hours off). Isosorbide products are administer in the morning, usually at 7am or 8 am, with the second dose after 7 hours later (2 pm to 3 pm). No additional doses are administered so that the patient has a nitrate-free interval.

d. **Hydralazine (Apresoline®) and Minoxidil (Loniten®).** Hydralazine and Minoxidil are direct acting peripheral vasodilators used in the treatment of hypertension. Hydralazine may be prescribed in combination with an oral nitrate in the treatment of congestive heart failure. The addition of hydralazine further dilates peripheral vessels and decreases workload on the heart.
4-5. AUTONOMIC NERVOUS SYSTEM VASODILATORS

The agent discussed in this paragraph is thought to dilate blood vessels supplying blood to skeletal muscles. Isoxsuprine (Vasodilan®) is sometimes used in the treatment of various conditions causing peripheral vascular disease. Dilating blood vessels to skeletal muscles allows greater blood flow to peripheral areas of the body. Such increased blood flow alleviates some of the symptoms normally associated with peripheral vascular disease (for example: numbness or tingling sensations in the toes and fingers or a feeling of never being warm enough regardless of the atmospheric temperature). The effectiveness of this agent has not been supported by objective studies. The side effects associated with isoxsuprine therapy are severe rash (with some patients), tachycardia, and nausea and vomiting. Vasodilan® is supplied as 10 milligram and 20 milligram tablets. The usual daily dosage is 30 milligrams to 80 milligrams in 4 divided doses.

Continue with Exercises

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EXERCISES, LESSON 4

INSTRUCTIONS. The following exercises are to be answered by marking the lettered response that best answers the question or best completes the incomplete statement.

After you have completed all the exercises, turn to “Solutions to Exercises” at the end of the lesson and check your answers with the solutions. For each exercise answered incorrectly, reread the material referenced after the solution.

1. A vasodilator is a drug that:
   a. Dilates blood vessels with a resultant increase in blood flow.
   b. Removes deposits of fat and calcium from the inside of vessels in order to increase blood flow.
   c. Causes the heart to beat faster causing an increase in blood flow to the brain and to the peripheral areas.
   d. Counteracts inadequate blood flow to the brain and peripheral areas by causing the arteries and veins to become more elastic.

2. Orthostatic hypotension is a condition characterized by:
   a. Dizziness, fainting, or vertigo caused by a rupture of blood vessels of the brain.
   b. Dizziness or fainting caused by excessive flow of blood to the semicircular canals of the inner ear.
   c. Fainting or dizziness because of inadequate blood supply to the brain.
   d. Fainting or dizziness caused by lack of adequate exercise.
3. Atherosclerosis is best defined as:
   a. A condition characterized by thickening, hardening, and a loss of elasticity of the walls of the blood vessels.
   b. A condition manifested by excruciating chest pain caused by lack of oxygen in the heart.
   c. A form of arteriosclerosis characterized by localized accumulation of fats in the arteries.
   d. A form of angina pectoris in which the vessels of the heart are occluded by fats and carbohydrates.

4. Amyl nitrite is a vasodilator that is used in the treatment of:
   a. Angina pectoris.
   b. Frostbite.
   c. Cyanide poisoning.
   d. a and b.
   e. a and c.

5. Isoxsuprine is used in the treatment of:
   a. Tachycardia.
   b. Various conditions causing peripheral vascular disease.
   c. Orthostatic hypotension.
   d. Irregular heartbeat and muscle tension.

6. What side effects are associated with nitroglycerin?
   a. Irregular heartbeat and tachycardia.
   b. Orthostatic hypertension and sedation.
   c. Acute angina attacks and flushing of the face.
   d. Headache and dizziness.
7. Hydralazine is used in:
   a. The treatment of hypertension and congestive heart failure.
   b. The treatment of night leg cramps and frostbite.
   c. The treatment of atherosclerosis.
   d. The prophylactic treatment of angina pectoris.

8. Which of the following best describes the concept of “nitrate-free” interval associated with the use of nitrates?
   a. Nitrates prescribed day on/day off, to reduce side effects.
   b. Nitrates prescribed 8-12 hours per day, followed by a 12-16 hours drug free interval to decrease tolerance and side effects.
   c. Nitrates prescribed every 6-8 hours and instructed to skip every other dose.
   d. Nitrates prescribed week on/week off, to reduce tolerance and side effects.

9. Match the drug name listed in Column A with its corresponding name listed in Column B.

<table>
<thead>
<tr>
<th>COLUMN A</th>
<th>COLUMN B</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____Minoxidil.</td>
<td>a. Sorbitrate®</td>
</tr>
<tr>
<td>_____Isosorbide dinitrate.</td>
<td>b. Nitroglycerin.</td>
</tr>
<tr>
<td>_____Isoxsuprine.</td>
<td>c. Loniten®.</td>
</tr>
<tr>
<td>_____Isosorbide mononitrate.</td>
<td>Imdur®.</td>
</tr>
<tr>
<td>_____Glyceryl trinitrate.</td>
<td>e. Vasodilan®.</td>
</tr>
</tbody>
</table>

Check Your Answers on Next Page
SOLUTIONS TO EXERCISES, LESSON 4

1. a (para 4-2a)
2. c (para 4-2b)
3. c (para 4-2e)
4. e (para 4-4a)
5. b (para 4-5a)
6. d (para 4-4b)
7. a (para 4-4d)
8. b (para 4-4c)
9. c Minoxidil. a. Sorbitrate®. (para 4-4d)
   a Isosorbide dinitrate. b. Nitroglycerin. (para 4-4c)
   e Isoxsuprine. c. Loniten®. (para 4-5a)
   d Isosorbide mononitrate. d. Imdur®. (para 4-4c)
   b Glyceryl trinitrate. e. Vasodilan®. (para 4-4b)

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