LESSON ASSIGNMENT

LESSON 6  Tuberculosis.

TEXT ASSIGNMENT Paragraphs 6-1 through 6-11.

LESSON OBJECTIVES After completing this lesson, you should be able to:

6-1. Identify the characteristics, signs/symptoms, diagnosis, and treatment for tuberculosis.

6-2. Identify the reservoir, sources, and transmission of tuberculosis infection.

6-3. Identify the measures in the tuberculosis control program.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.
LESSON 6

TUBERCULOSIS

6-1. DEFINITION

Tuberculosis is a chronic disease caused by the bacteria *Mycobacterium tuberculosis*. The initial disease may not be noticed, but eventually the infection may spread to various parts of the body (for example: tuberculosis of the bones and joints, intestinal tuberculosis, and urinary tract tuberculosis). The incidence of tuberculosis is less today than in the past. In the United States Army in World War II, the number of tuberculosis cases was 1 per 1,000 soldiers. By 1982, only 250,000 cases were reported in the United States. The decline in the number of cases can be attributed to three factors: education about causes of tuberculosis; better diet and nutritional information; and early diagnosis and treatment of tuberculosis cases.

6-2. COMMUNICABILITY OF INFECTION

a. Reservoir, Sources, Transmission Route. The most common reservoir of tuberculosis is man. The source of infection is respiratory secretion of individuals who have active pulmonary lesions. Tuberculous bacteria may be transmitted by direct or indirect contact with the patient who has open lesions. The most common route of transmission, however, is by inhaling airborne droplet nuclei. When a patient coughs or sneezes, a person may inhale the bacteria in the air and, if susceptible, may contract tuberculosis. Family, military, and institutional living can contribute to the spread of tuberculosis if a person has an active case that is unrecognized and, consequently, untreated. A reservoir for *Mycobacterium bovis*, the bovine strain of tuberculosis, is diseased cattle. Man ingests this bacillus by drinking the raw milk from such cattle. Man may also contract this type of tuberculosis by inhaling airborne organisms in and around barns that have infected animals or by handling infectious animal products. Since herds of animals are continuously tested for tuberculosis and milk is pasteurized, this form of tuberculosis has been controlled.

b. Incubation Period. The incubation period is usually about four to six weeks from the time of effective exposure to the appearance of a primary lesion of first infection. The time between the first infection and reinfection of tuberculosis may be many years. If the individual is reinfected, the length of time necessary for new lesions to develop depends on the general health of the person and the source and numbers of organisms entering his system.
c. **Communicability.** A patient is infectious for as long as he discharges tubercle bacilli. The degree of communicability depends on several factors: density of contaminated droplets in the air; coughing habits of the patient; and air circulation and fallout in the particular environment. During the period when the patient is infectious, an uninfected person needs to inhale at least one infectious droplet nucleus to become infected. The healthy person must inhale tubercle bacilli so that they are carried far down the airways to a point in the lung where fixed mononuclear phagocytes can pick the droplets up and droplet intracellular multiplication can begin. The infected patient's sputum, if it carries enough bacilli, is a source of infection when the patient coughs or sneezes thus spraying the air with bacilli. If there are several people living close together, just one of them being infected with tuberculous bacilli can spread the disease to the others.

d. **Immunity.** How susceptible people are to infection in general is influenced by several factors: age, sex, race, nutrition, and general health. In regard to tuberculosis, children under 3 years old are the most susceptible. There have been fewer cases of tuberculosis in children since bovine tuberculosis has been controlled. (Children are no longer consuming infected dairy products.) There are fewer cases of tuberculosis among Caucasians than among Blacks and American Indians, but no one is sure of the reason. Perhaps through the years only Caucasians most resistant to tuberculosis have survived. In general, possibly Caucasians live in better environments and eat more nutritionally balanced meals thus giving them better health. The number of cases of tuberculosis is usually greater among city dwellers than among those who live in the country. City people live closer together; therefore, one infected city dweller will probably come in contact with and pass on the tuberculosis infection to more people than a country dweller.

6-3. **SIGNS/SYMPTOMS**

From the time of infection, it takes about four to eight weeks for a person to develop tuberculosis. The person may have no symptoms, mild symptoms, or nonspecific symptoms. If there are symptoms, these are the most common:

a. Fatigue.

b. Anorexia.

c. Weight loss.

d. Irregular menses.

e. Low grade fever.

f. Night sweats.
g. Cough (which has no specific characteristics).

h. Hemoptysis (blood in the sputum).

i. Pleuritic chest pain (pain in the pleural chest cavity).

6-4. TYPES OF TESTS

a. Chest X-ray. In almost all cases, a chest x-ray will show the disease. A single chest x-ray is not usually enough to diagnose tuberculosis. This is because tuberculosis lesions behind ribs, cardiovascular structures, and the diaphragm will not show up on a chest x-ray for tuberculosis. Several chest x-rays, therefore, are needed to establish the activity of the bacilli and to select and determine the appropriate treatment.

b. Tuberculin Skin Testing. The basis of tuberculin skin tests is that the skin is hypersensitive to a specific bacterial protein antigen. Administer the antigen and examine the induration (hardening of the area on which the antigen was placed). A positive reaction (induration 10 mm or more in diameter) indicates only exposure to tuberculosis; it does not necessarily mean that the person has tuberculosis. To find out whether the person has tuberculosis now, use x-ray or bacteriological methods. People who have a negative tuberculin reaction include the following: those who have never been infected; those who are in the preallergic early stage of first infection, and, strangely enough, those with advanced terminal tuberculosis.

   (1) Tine test. The tine test uses dried, old tuberculin (OT) on multiple metal tines (sharp, pointed prongs like a fork) which are in a round, plastic head. When the tines are pressed against an individual's skin, the antigen is forced between layers of the skin in the same manner as an injection. This method of testing is safe and convenient for mass surveys. The site where the test was done should be read between 48 and 72 hours after the test was performed. What the site looks like determines whether the test resulted in a positive take, a doubtful take, or a negative take as noted below:

   (a) Positive take--induration but no erythema (abnormal) skin redness.

   (b) Doubtful take--2 mm induration.

   (c) Negative take--less than 2 mm induration.

   (2) Mantoux test. This test, used for adult testing, must be used if the tine test is doubtful or positive. The test requires intradermal injection of antigen 0.1 ml (1 I.U.) of purified protein derivative (PPD). If a fairly high level of susceptibility is expected, 0.1 ml (0.5 I.U.) of PPD may be used. Read from 48 to 72 hours. Note the following information:
(a) Positive take--10 mm induration or more.

(b) Doubtful take--5 mm through 9 mm induration.

(c) Negative take--less than 5 mm induration.

(3) Conversion. Conversion refers to a positive reaction that has occurred within one year after a known negative reaction. If the person tested is under 35 years old, begin treatment for tuberculosis immediately.

6-5. GENERAL CARE

How rapidly and/or how well tuberculosis lesions heal depends on two factors: specific drug treatment and the body's defense mechanism. Bed rest is necessary only if the patient has a fever, hemoptysis (blood-stained sputum), or a severe cough. A patient with any of these symptoms may need a few weeks of bed rest. The patient whose sputum contains tuberculosis bacilli should be isolated until effective treatment has been given for at least two weeks. Generally, these and other patients whose drug treatment has been established can return to normal physical activity.

6-6. DRUG THERAPY

Drug treatment must continue for at least eighteen to twenty-four months. A minimum of two drugs should be used concurrently, but there is a strong trend toward the use of three drugs. Drug therapy appears to be most effective when taken in a simple daily dose on an empty stomach.

a. Isoniazid.

(1) Drug use. Isoniazid (INH) should always be included in the original treatment and always used in conjunction with other anti-tuberculosis drugs. The dosage for adults is 5 mg/kg per day up to 300 mg per day. This is the most effective drug at the present time; however, there may be adverse reactions.

(2) Adverse reactions. If the dosage is the usual 5 mg/kg daily, adverse reactions to isoniazid are unusual. Cases of hepatitis thought to have been caused by the drug have been reported. If the patient has a liver dysfunction, be cautious in prescribing the drug. Tell patients to be sure to stop taking the drug and notify the doctor if any adverse signs/symptoms occur. A patient taking large doses of isoniazid may experience peripheral neuropathy (disturbances in the peripheral nervous system) and, occasionally, central nervous system irritability caused by depletion of pyridoxine, one of the forms of vitamin B6. Urine retention is another possible adverse reaction from isoniazid.
b. **Rifampin (Rifadin®).** This drug, a semisynthetic derivative of rifamycin, is given orally and usually well tolerated. The drug distributes readily into all body tissue fluids including the cerebral spinal fluid (CSF). The dosage is 600 mg (two 300 mg caps). Rifampin must be used along with another anti-tuberculosis drug. Adverse reactions include anorexia, diarrhea, and headache.

c. **Streptomycin.**

   (1) **Drug use.** Streptomycin, less effective than isoniazid in advanced tuberculosis cases, must be given in conjunction with other drugs. The dosage is 1 to 2 mg daily by intramuscular injection.

   (2) **Adverse reactions.** If streptomycin is used daily, the drug may cause eighth nerve damage (vertigo, deafness). If the drug is continued, the damage may be irreversible. Occasionally, the patient suffers generalized dermatitis (inflammation of the skin) in which case use of the drug must be discontinued.

d. **Ethambutol (Myambutol®).**

   (1) **Drug use.** Ethambutol, the principal second line drug, must be used in combination with another drug, normally isoniazid. Ethambutol will prevent the development of organisms which are resistant to major drugs. The dosage is 15 mg/kg, given orally.

   (2) **Adverse effects.** This drug has few side effects. Optic neuritis (inflammation of the optic nerve) is one possible side effect, but it is usually minor and reversible. Before and during treatment with this drug, the patient's clarity of vision should be checked. If vision becomes less clear, the use of this drug should be discontinued. Since clearness of vision cannot be properly checked in infants and young children, avoid using ethambutol with these patients.

e. **Bacille Calmette-Guerin Vaccine.** Bacille Calmette-Guerin (BCG vaccine, administered intradermally, is a living, attenuated strain of tubercle bacilli of bovine origin. The vaccine offers no positive protection to tuberculin-negative people but can give false-positive readings. The vaccine converts at least 90 percent of tuberculin-negative people to a state of skin sensitivity. The protection given by vaccination is only partial, and no one is quite sure how long the vaccination lasts. Mass vaccination with this vaccine is applicable only in situations where risk of infection and the number of tuberculin-negative contacts of active disease are both high.

   (1) **Drug use.** The dosage is 50 mg per day by mouth. Use pyridoxine (B6) only if the patient experiences side effects when taking isoniazid. This drug is not used routinely.

   (2) **Adverse effects.** Adverse effects include irritability or depression.
6-7. VACCINATION SITE REACTION

Read the vaccination site this way. A skin induration of 10 mm or more is considered a reaction. Less than 10 mm induration is a nonreaction. Read the vaccination site using a millimeter ruler and only the amount of induration, not the skin redness. Reactions are classified in these three types: a positive reaction; a negative reaction; and a conversion reaction.

6-8. POSITIVE REACTION

The induration is 10 mm or more in diameter and indicates that the person has a tuberculin infection now or has had an infection in the past. Two to eights weeks after a person is infected with the tubercule bacillus, the skin test may provide a positive reaction. Disadvantaged people in all countries have a higher rate of positive reactions.

6-9. NEGATIVE REACTION

Induration less than 5 mm in diameter is considered a negative reaction and indicates that a tuberculosis infection is unlikely. A variety of factors make it possible for the tuberculin reaction to decrease in size or even disappear even though the person has tuberculosis. These factors include overwhelming tuberculosis, exanthematous (eruptive) diseases, corticosteroid treatment, sarcoidosis, debility, and increased age. Also consider that there may be something wrong with the materials used in testing. If you suspect that the person may have tuberculosis, even though the reaction is negative, give that test again or use another method of testing for tuberculosis.

6-10. CONVERSION REACTION

A positive reaction that has developed within a year after a negative reaction is called a conversion reaction. This means that the skin induration has changed from a skin induration of less than 10 mm in diameter a year ago to a skin induration greater than 10 mm in diameter and that the increase in the size of the induration is at least 6 mm. The importance of this finding is that it indicates that the person may have had a tuberculosis infection recently. That person will need to be checked periodically because the possibility of developing tuberculosis is greatest during the first two years after an infection.

6-11. GENERAL MEASURE OF CONTROL

It is more difficult to control outbreaks of respiratory infections (including tuberculosis) than many other types of communicable diseases. In general, control efforts are based on improving personal hygiene, avoiding contacts with patients and carriers, controlling dust and aerial contamination, preventing overcrowding and fatigue, and immunizing when applicable.
a. **Avoidance of Direct Contact.** Patients with a respiratory disease such as tuberculosis must be diagnosed, isolated if necessary, and treated as soon as possible. Additionally, these patients should learn and practice personal hygiene measures such as covering the mouth when coughing or sneezing.

b. **Person Hygiene.** Personal hygiene is one of the most important respiratory disease control measures. The approach is through the practice of simple health habits. Covering the nose and mouth when sneezing or coughing and washing the hands should be routine practices. People infected should avoid contact with healthy persons. Personal articles such as towels, drinking glasses, and toothbrushes are not shared. Healthful exercise, fresh air, and sunshine should be encouraged.
EXERCISES, LESSON 6

INSTRUCTIONS. Answer these exercises by writing the answer in the space provided. After you have answered all the exercises, turn to “Solutions to Exercises” at the end of the lesson and check your answers.

1. Tuberculosis, a chronic disease, is caused by _____________________________.

2. List three reasons for the decline in the number of tuberculosis cases.
   a. _____________________________.
   b. _____________________________.
   c. _____________________________.

3. List four signs/symptoms of tuberculosis.
   a. _____________________________.
   b. _____________________________.
   c. _____________________________.
   d. _____________________________.

4. Two methods of diagnosis for tuberculosis are __________________ and tuberculin skin testing.

5. List two methods of transmission of tuberculosis.
   a. _____________________________.
   b. _____________________________.

6. The __________________ test and the __________________ test are two types of skin tests which can be used to diagnose tuberculosis.
7. Both types of skin tests are based on the fact that ________________________.

8. List three adverse reactions that isoniazid, the drug of choice in tuberculosis treatment, can have.
   a. ____________________________________________.
   b. ____________________________________________.
   c. ____________________________________________.

9. __________________ is a tuberculosis treatment drug that moves readily into all the body tissue fluids, including the cerebral spinal fluid.

10. A patient being treated for tuberculosis with the drug __________________ may experience adverse reactions such as vertigo and generalized dermatitis.

11. Name an adverse reaction which might be experienced by a patient taking the drug ethambutol for tuberculosis ________________________.

12. A tuberculosis patient can infect others as long as the patient discharges ________________________.

13. List three reasons when a tuberculosis patient would need bed rest.
   a. ____________________________________________.
   b. ____________________________________________.
   c. ____________________________________________.

14. The length of time between exposure to tuberculosis and the appearance of a primary lesion of first infection is usually about ________________________.

   Check Your Answers on Next Page
SOLUTIONS TO EXERCISES, LESSON 6

1. The bacteria Mycobacterium tuberculosis. (para 6-1)

2. You are correct if you listed any three of the following:
   - Education.
   - Diet.
   - Preventive measures.
   - Early diagnosis. (para 6-1)

3. You are correct if you listed any four of the following:
   - Fatigue.
   - Night sweats.
   - Irregular menses.
   - Anorexia.
   - Cough.
   - Pleuritic chest pain.
   - Weight loss.
   - Blood-stained sputum.
   - Low grade fever. (paras 6-3a-i)

4. Chest x-ray. (para 6-4a)

5. Inhaling an airborne droplet which has the tuberculosis bacteria.
   Drinking raw milk from cattle infected with the bovine strain of tuberculosis.
   (para 6-2)

6. Tine; Mantoux. (paras 6-4b(1), (2))

7. The skin is hypersensitive to a specific bacterial protein antigen. (para 6-4b)

8. You are correct if you listed any three of the following:
   - Peripheral neuropathy.
   - Central nervous system irritability.
   - Urine retention.
   - Depletion of vitamin B6. (para 6-6a(2))

9. Rifampin (Rifadin®). (para 6-6b)

10. Streptomycin. (para 6-6c(2)

11. Optic neuritis. (para 6-6d(2)(b)

12. Tubercle bacille. (para 6-2c)

13. Patient has a fever.
    Patient has blood-stained sputum.
    Patient has severe cough. (para 6-5)

14. Four to six weeks. (para 6-2b)

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