

Nurses and Fight Against Tuberculosis

PURI, M.M. AND JOHN, T.

Introduction

Tuberculosis is an ancient disease that has left its traces in stone age skeletons and Egyptian mummies. Now TB epidemic is worse than at any other time in human history. It is a terribly debilitating disease killing three million people in 1995, more than at the peak of epidemics in the late 19th century when modern antibiotics were not available. Presently, the world faces three epidemics from tuberculosis. The first of these is the re-emergence of tuberculosis itself. The second epidemic is a cruel duet of coinfection with HIV and tuberculosis. The third epidemic is in our midst-namely, multidrug resistant tuberculosis. What can we do to overcome the problem of TB? Nurses had always contributed to the care and treatment of people with TB. The most effective way to fight tuberculosis is to stop it at the source. The source of the epidemic's uncontrolled spread is sick and infectious TB patients who are not cured. Once people are cured of TB, they can no longer infect others.

Causative Organism

Tuberculosis is a chronic bacterial infection caused by *Mycobacterium Tuberculosis* that is characterized by the formation of granulomas in the infected tissues and by cell mediated hypersensitivity reaction. The usual site being the lungs but the other organs may be involved. In the absence of effective treatment for active disease, a chronic wasting course is usual and death ultimately supervenes.

Puri, M.M. is Chest Physician and John, T. is Nursing Superintendent. L.R.S. Institute of Tuberculosis and Allied Diseases, New Delhi.

The *Mycobacterium Tuberculosis* is one of the more than 30 well characterized and many unclassified members of the genus *Mycobacterium*. Most mycobacteria are not pathogenic for humans and many are usual inhabitants of soil and water. *Mycobacterium Tuberculosis* is described as a non-motile, non-spore-forming, rod-shaped bacillus that does not produce toxin. It is commonly known as an 'acid-fast' bacillus because the lipid in its cell wall makes it resistant to discoloration with acid-alcohol. Because of this, Ziehl-Nelson staining make them appear as red-stained rods. *Mycobacterium tuberculosis* has a slow rate of growth dividing every 18 to 24 hours (as opposed to *Escherichia coli* which divides in less than an hour). Like all other micro-organisms, the tubercle bacilli can mutate and change its characteristics, such as virulence and drug sensitivity. The incidence of Multi drug resistant strains of TB is rising and causing real problem in providing effective treatment.

It is important to understand the difference between tuberculous infection and tuberculosis disease. TB infection can be present with or without the disease. People who have Living tubercle bacilli present without the clinically active disease are considered to have a tuberculosis infection. They are not infectious to others and have negative bacteriologic studies, but usually have a positive tuberculosis skin test (Mantoux test).

The pathogenesis of TB occurs in two phases: The initial (primary) infection with the tubercle bacilli. The subsequent development of TB depends on a number of factors, such as the amount of bacteria implanted in the lungs, host's body defences and

nutritional status.

Primary Infection : Primary infection occurs on first exposure to tubercle bacilli. Inhaled droplet nuclei are so small that they avoid the mucociliary defence of the bronchi and lodge in the terminal alveoli of the lungs. Infection begins with multiplication of the tubercle bacilli in the lungs. This is Ghon focus. Lymphatics drain the bacilli to the hilar lymph nodes. The Ghon focus and related hilar lymphadenopathy form the primary complex. Bacilli may spread in the blood from the primary complex throughout the body, which explains how TB is found in other sites of the body. The immune response delayed hypersensitivity and cellular immunity develops about 4-6 weeks after the primary infection. The size of the infecting dose of bacilli and the strength of the immune response determine what happens next. In most cases the immune response stops the multiplication of bacilli. However, a few dormant bacilli may persist. A positive tuberculin skin test would be the only evidence of infection. The immune response in a few cases is not strong enough to prevent multiplication of bacilli, and disease occurs within a few months.

Following primary infection, rapid progression to intra-thoracic disease is more common in children than in adults. Chest X-ray may show intrathoracic lymphadenopathy and lung infiltrates.

Post-Primary TB : Post-primary TB occurs after a latent period of months or years after primary infection. It usually occurs in adults. It may occur either by reactivation or by reinfection. Reactivation means that dormant ba-

cilli persisting in tissues for months or years after primary infection start to multiply. This may be in response to a trigger, such as weakening of the immune system. Reinfection means a repeat infection in a patient who previously had a primary infection. Post primary TB usually affects the lungs but can involve any part of the body. The characteristic features of post-primary pulmonary TB are : extensive lung destruction with cavitation.

A Global Problem

Someone in the world is newly infected with TB literally with every tick of the clock — one person per second. Fully one third of the world's entire population is now infected with TB bacillus. In the next decade it is estimated that 300 million more people will become infected, 90 million people will develop the disease. Worldwide in 1995 there were about 9 million new cases of TB with 3 million deaths. These deaths comprised 25% of all avoidable deaths in developing countries. 95% of TB cases and 98% of TB deaths are in developing countries. 75% of TB cases in developing countries are in the economically productive age group (15-50 years).

In India

The rates observed in various surveys conducted in India, have been used to estimate the approximate average number of cases and deaths, etc. The likely estimate of disease in India could be on average: Bacteriologically (culture) positive cases 4.4 million, Radiologically active bacteriologically negative 2.3 million and annual tuberculosis mortality 0.42 million. TB is the number one infectious killer of mankind. Nearly 10% of all deaths are contributed due to tuberculosis. Mortality rate was observed for the last time in a population survey way back in 1966; it was reported to be about 90 per

100,000 (could be half of that, as hypothesised in recent times). TB is the highest single cause of death in women in reproductive age group. Nearly 40% of female population being in the age group of 20-44 years.

38 per cent population in all ages and both sexes is infected with tubercle bacilli (prevalence of Infection). In males, almost 70% of persons above 40 years of age were infected. About 2% of persons in all ages, both sexes, had pulmonary tuberculosis (prevalence of disease), but only 0.4% could be overage prevalence rate of bacillary case (in 5 + age group). The incidence of cases was observed to be a third of the prevalence, on the overage. Pulmonary Tuberculosis is an adult disease. Ninety three per cent of cases were distributed in population aged 20 years and above. Only 7% of total cases were in the population 0-19 years.

Detection and Diagnosis

TB can present in a variety of ways and will vary according to the site of disease. It is usual to find that the symptoms develop gradually and are often vague. The insidious onset may include the following symptoms : Cough usually productive, occasionally with blood streaked sputum; Anorexia; Weight loss; Low grade fever, sometime High grade, intermittent; Sweating and or chills at night; Dull aching chest pain or tightness; If TB has spread to other body organs (extrapulmonary TB) symptoms will relate to the affected organs.

Diagnosis

Clinical screening by assessment of symptoms identifies pulmonary TB suspects among patients attending health facilities. The most important are cough more than 3 weeks, sputum production and weight loss. However

cough is not specific to pulmonary TB. Over 90% of patients with sputum smear pulmonary TB develop a cough soon after the disease's onset. Cough is common in smokers and in patients with acute upper or lower respiratory tract infection. Most acute respiratory infections resolve within 3 weeks. Therefore, a patient with a cough for more than 3 weeks is a pulmonary TB suspect and must submit sputum for diagnostic microscopy. Sputum microscopy is the most cost effective method of screening pulmonary TB in high prevalence countries.

A pulmonary TB suspect should submit 3 sputum specimens for microscopy. The chance of finding tubercle bacilli are greater with 3 sputum specimens than with two specimens or one specimen. Secretions build up in the airways overnight. So an early morning sputum sample is more likely than a sample later in the day to contain tubercle bacilli. The diagnosis of Pulmonary TB is usually on an out-patients basis. A few TB suspects are severely ill and/or bed-bound and therefore need investigation as in-patients. It may be difficult for an out-patient to provide 3 early morning samples, therefore, in practice an out-patient usually provides sputum samples as follows :

Day 1 (Specimen 1) : Patients provide an "on the spot" specimen under supervision when he presents to the health facility. Give the patient a sputum container to take home for an early morning specimen the next day.

Day 2 (Specimen 2) : Patient brings an early morning specimen.

Day 2 (Specimen 3) : Patient provides another "on the spot" specimen under supervision.

An admitted patient can provide three early morning sputum samples under supervision in hospital. If a patient can't produce a sputum specimen,

a Nurse or Physiotherapist may help to induce sputum production by hypertonic nebulised saline.

Mycobacteria are "acid-fast bacilli" (AFB). The simple stain detected AFB is Ziehl Neelsen (Z-N) stain. In most cases of sputum smear-positive pulmonary TB, a chest X-ray is unnecessary. In those few cases of sputum smear positive pulmonary TB when a Chest X-ray is necessary the indications are as follows : (a) Suspected complications in the breathless patients, needing specific treatment, e.g. pneumothorax. (b) Frequent or severe haemoptysis to exclude bronchiectasis or aspergilloma. (c) Only one sputum smears positive out of three, in this case an abnormal chest X-ray is necessary additional criterion for the diagnosis of sputum smear positive pulmonary TB.

For the patient who continues to cough despite a course of broad spectrum antibiotic and who has had 3 negative sputum smears it is often worthwhile repeating the sputum smears after 2 weeks. If you still suspect TB despite negative sputum smears, the patient needs a chest X-ray.

In a population with high TB prevalence, Montoux test (the tuberculin skin test) is of little value in the diagnosis of TB in adults. A positive skin test does not by itself distinguish tuberculosis infection from tuberculosis disease. Previous exposure to environmental mycobacteria may also result in a false positive test result. Conversely, the tuberculin skin test result may be negative, even when the patient does have TB. Conditions often associated with a false negative tuberculin skin test include HIV infection, severe malnutrition and miliary TB.

Prevention and Transmission

BCG

BCG vaccination is recommended

against TB, as part of the United Nations Expanded Programme on Immunization. BCG is a live attenuated vaccine. These days Freeze dried vaccine is used. If stored at Subzero temperature (-20° C), the vaccine will remain good for use for 2 years. At the city/district store, it may be stored at 2 to 8°C and good for use for one month. At the peripheral level, at 2 to 8°C it is good for use up to one week. It should be transported in thermos flasks with ice to the outreach immunization clinics. The vaccine must be protected from exposure to light during storage (wrapped up in a double layer of red or black cloth) and in the field. Normal saline is recommended as a diluent for reconstituting the vaccine, as distilled water may cause irritation. The constituted vaccine may be used up within 3 hours, and the left-over vaccine is discarded. The usual dose is 0.05 ml in neonates and infants under the age of 3 months, 0.1 ml in old children. BCG has little or no effect in reducing the number of adult cases of Pulmonary Tuberculosis. The benefit of BCG is in protecting young children against disseminated and severe TB, eg., TB meningitis and miliary TB.

The WHO recommends a policy of routine BCG immunisation for all neonates shortly after birth. It is not known if HIV infection reduces the protection of BCG against TB in children. There is some evidence that conversion to a positive tuberculin test after BCG is less frequent in HIV-infected children. There have been a few case reports of local complications and disseminated BCG infection after BCG immunisation of HIV infected children. However prospective studies comparing BCG immunisation in HIV-infected and uninfected infants showed no difference in risk of complications. So, in the vast majority of cases, BCG immunisation is safe. WHO recommends that in a high prevalence country, the possible benefits of BCG immunisation outweigh the possible

disadvantages.

Sputum Positive Cases

From the public health point of view, the best way to prevent TB is to provide effective treatment to infectious TB cases. This interrupts the chain of transmission.

Transmission

Most commonly, the tubercle bacilli is inhaled into the lungs via aerosolised airborne particles called droplet nuclei. This droplet transmission commonly occurs when a person with infectious TB of the lungs forcefully exhales or coughs. One cough can release 3000 droplet nuclei, and it needs fewer than 10 tubercle bacilli to initiate infection.

The length of contact between the sources also affects the transmission rates. The more prolonged and intense the exposure, the greater the likelihood that transmission will occur. Lengthy and close contact most often occurs between family members or individuals living in overcrowded housing conditions.

Good ventilation helps reduce transmission indoor. Sunlight is a source of ultraviolet light which can kill TB bacilli. So, ideally, wards should have large windows. In wards, outpatients, clinics, sputum collection rooms, and microbiology laboratories, keep the doors closed and the windows open.

A face mask decreases the risk that the person wearing the mask can infect other people. A TB suspect or a TB patient, if possible, should wear a mask if moving from one part of a hospital to the other. Often a health worker wears a mask to protect himself against TB, e.g. when working on the TB ward. Infact, a mask is generally not very good for protecting the person wearing the mask from inhaling other people's infectious droplets. The exception is when a worker is supervising a cough induced

procedure. e.g.m bronchoscopy, or sputum induction using rebulised hypertonic saline.

Nurses should teach TB suspects and TB pateints simple measures how to decrease the risk of transmitting TB. This includes covering the mouth with hand when coughing, and using sputum pots with lids. When examining TB patients or suspects, ask the patient to turn his head. This is to avoid coughing directly at the Nurses or health workers.

Treatment of TB

The successful treatment for pulmonary TB depends on two factors : 1. The correct prescription of anti-tuberculous drugs. 2. The pateint's compliance with the treatment.

Newly diagnosed, previously untreated cases of TB has traditionally been given a daily six month regimen of chemotherapy using Rifampicin, Isoniazid, Pyrazinamide and Ethambutol for the first two months of intensive phase followed by Rifampicin and Isoniazid for further four months of continuation phase. The changeover from intensive to continuation phase is done only if sputum for AFB is negative at the end of 2 months of Chemotherapy, otherwise intensive phase is extended for one more month. These drugs with appropriate dosage adjustments particularly of Isoniazid and Ethambutol, can also be used thrice a week under direct supervision. (Intermittent Short Course Chemotherapy, directly observed. DOTs)

Lack of patient compliant and inappropriate prescribing means that 50% of patients are not being cured. In addition these factors lead to the tubercle bacilli becoming resistant to the drugs used. Emergence of drug resistant strains, which are now called multidrug resistant TB (MDR-TB) is a serious threat to national TB programmes. Treatment of multidrug

resistant tuberculosis is at best highly unsatisfactory. Most people with MDR-TB in poor countries usually die for lack of effective treatment. There is no cure for some multidrug resistant strains of TB. More frightening is that multidrug resistant tuberculosis is spread through air and is more contagious than AIDS. If the multidrug resistant strains become predominant we will be back in the pre-antibiotic days. All we will be able to do is pray and send people off to sanitoriums. The only hope of overcoming the problems of multidrug resistance is prevention. This means ensuring that every patient who starts anti-TB treatment finishes it.

TB, HIV and AIDS

Infection with Human Immunodeficiency virus is considered to be the greatest acquired risk factor for developing TB. Over ten years TB has begun to take the lives of more and more HIV positive patients. In one out of every three people who die of AIDS, it is TB that actually kills them. Worldwide, HIV/AIDS infection is found in Africa. However, the virus is now spreading explosively in Asia including India. Approximately 60% of HIV-positive adults develop AIDS within 12-13 years. Once they do, their average survival time is approximately 6 months in developing countries and around three years in developed countries. When HIV and TB come together the effect is explosive. People infected with Tubercle bacilli during their childhood usually do not develop TB because their immune system can prevent further multiplication of the bacteria. However, the bacteria are not destroyed, but lie dormant in the body. Because HIV suppresses the immune system, people who are carrying the TB germ lose their immune protection against the bacteria that have remained in their body. The bacteria may reactivate TB to develop. People co-

infected with TB and HIV are up to 30 times more likely to develop active TB in a year than those who are infected with TB alone.

Control and Nurses

Nurses have always had an important contribution to make to the care and treatment of people with tuberculosis (TB). Typical Nursing activities with TB patients involved home as well as institutional care, administering drug, contact tracing, working with the families and communities, referring patients to source of assistance, monitoring their adherence to treatment plans, and maintaining a safe environment.

There are a number of aspects to the Nurse's role when working with TB patients. They are : Health promotion, encouraging and ensuring compliance with treatment, providing care for infectious patients in hospital or in the community, screening and contact tracing.

Health Promotion

Nurses can help people with TB to gain control over and improve their own health. They should explain to patients and their contacts the nature of the disease. This should be done with sensitivity and consideration of the stigma often associated with TB. It is also important to explain that completion of full course of treatment is necessary not only to effect a cure but also to prevent the development of multiple drug resistance. Possible reactions to the treatment should be explained to the patients and to contact the doctor should there be any side effect. Patient should be explained the importance of attending follow-up sessions at the out-patients clinic. They should be properly guided from where they can collect the supplies of drugs.

(To Be Continued)