Control of Tuberculosis in Institutions

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Tuberculosis remains a public health problem in several circumstances in the U.S. even today, due largely to the ability of *M. tuberculosis* to persist for decades in healthy persons. It manifests most commonly as sporadic disease in elderly persons infected years before. In Arkansas, for example, more than 50 percent of our new cases are patients over the age of 65. When the disease appears in a group of institutionalized persons, it may endanger the health of a significant number of other persons. This is most likely to occur in nursing homes, mental hospitals, prisons, colonies for retarded persons and ordinary schools.

Spread of tuberculous infection aboard ship has been well documented, and the Navy now has a program of tuberculin testing and prophylactic therapy to prevent a recurrence. Spread of infection to personnel in a nursing home in North Dakota has recently been described. I once observed 11 of 44 tuberculin-negative hospital employees who were infected when they were exposed to a single patient in a Milwaukee hospital, King and Geis described an epidemic of tuberculosis in the Cook County jail in Chicago.

We have recently described evidence of a prolonged and subclinical epidemic of tuberculosis in a prison and showed that infection acquired in a prison often manifests as disease only after the subject has been released. More recently, we have encountered a small epidemic in each of two nursing homes. A description of the salient features of these experiences will illustrate the problem and form the basis for describing practical control measures for various situations.

**Epidemic of Tuberculosis in a State Prison**

One of the two large prisons in Arkansas has enforced a strict program for tuberculin testing all admissions and administration of prophylactic INH to reactors since they had an active case of tuberculosis in 1969. Repeat skin testing on an annual basis has revealed no evidence of new infection at that prison for ten years. This is as it should be.

In the other Arkansas prison, only lip service was given to tuberculosis control and the record showed that two to three cases of tuberculosis had occurred there each year for at least eight years. Again, in 1976 there were two active cases in the first six months. Thereafter, a careful search yielded an additional eight cases, giving a total of ten cases in a population of 1,500, making a case morbidity of 670/100,000, compared with a rate of about 21/100,000 in Arkansas that year.

Internal movement of inmates and a rapid turnover (about 100 per month) precluded a conventional epidemiologic study, but the discovery of skin test data from several mass testings made it possible to document that transmission of tuberculous infection was occurring in this prison. The study of several annual cohorts of new inmates clearly showed that tuberculin conversion increased with time an inmate spent in the prison. The frequency of tuberculous infection present at the time of admission to that prison was three-times higher for this prison's recidivists than for inmates entering this prison for the first time. Eight of 18 patients whose disease occurred from 1975 through 1977 were shown to have acquired the infection during a previous term in the prison. In addition, a study of all active tuberculosis cases among adult men in Arkansas for the previous ten years showed that 9 percent had been incarcerated in this prison in the past, compared with 1 percent of all adult men with a prison record, a highly significant nine-fold increase over the expected.

This finding indicates that an epidemic of tuberculosis can exist and remain inapparent for a long time, due to the rapid turnover of inmates and the slow and uncertain incubation of tuberculous infection and resultant tuberculosis. The full significance of the latter factor became obvious when we learned of transmission of tuberculous infection to the family of a former inmate who had been infected while in prison but released just before our intensive work began. The wife and two children were infected and one of the children died of tuberculous meningitis.

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which was not suspected in time for treatment to be effective. Finally, a survey of other state health departments showed that the potential for similar problems exists in the large prison of at least 40 other states. The epidemic in this Arkansas prison has been completely terminated now and there has not been either an active case nor a tuberculin converter found in the last 18 months.

**EPIDEMICS IN NURSING HOME AND MENTAL HEALTH INSTITUTIONS**

A patient was admitted to a 230-bed nursing home with a clinical diagnosis of carcinoma of the lung with no consideration having been given to tuberculosis. He continued to cough and lose weight, but did not deteriorate as rapidly as one would expect from carcinoma. After about 12 months, further studies were performed and cavitary tuberculosis was found. The sputum smear and culture were strongly positive for tubercle bacilli. From this rather prolonged and intensive exposure, 31 patients (20 percent of 124 previously negative) were found to have been newly infected (indicated by changing from negative to a strongly positive reaction to PPD). In three of these converters, two of whom were over the age of 80, clinical disease developed with abnormal x-ray film findings and positive bacteriology. Another 18 patients with large tuberculin reactions were almost surely converters also, thus giving a total of 49 patients out of a population at risk of 172 or a new infection rate of 28 percent. Five members of the staff were infected during the year, as shown by definite tuberculin conversion. The small proportion of staff infected as compared with patients is consistent with the time spent by members of the two groups in the contaminated environment.

In a ward housing elderly persons in a state hospital, a similar situation developed when a routine x-ray examination of a long-time resident showed evidence of recrudescence tuberculosis, but symptoms were minimal and the radiologist’s report was overlooked. At least two secondary cases have been found so far, but the detailed epidemiologic study of the institution is not yet complete.

In both of these situations, a greater awareness of the sporadic nature of tuberculosis among the elderly might have prompted a closer surveillance and detection of clinical cases before the infection was spread to others. Primary tuberculosis developed in several elderly persons and it was necessary to give prophylactic therapy to a number of very elderly persons who had previously eluded significant contact with the tubercle bacillus.

**TRANSMISSION IN SCHOOLS AND “COLONIES” FOR RETARDED CHILDREN AND ADULTS**

A 60-year-old teacher in a small town developed smear-positive pulmonary tuberculosis as a result of recrudescence of ancient disease, and infected ten children in her class. Although she was known to have had tuberculosis 25 years earlier, her annual health examinations were cursory and the reactivation of infection was not discovered until symptoms were prominent. In 1947, the famous paper of Hyge documented the tragedy that can result from such an event and in 1952 Bates and colleagues brought it home to us in Arkansas with their study of an epidemic in a boys’ correctional school.

**EFFECTIVE TUBERCULOSIS CONTROL FOR INSTITUTIONS**

If tuberculosis control is to be effective despite steady erosion of funds, wasteful screening must be abandoned and efforts tailored to the particular type of risks present in a given institution. Toward this end, I would propose the following types of programs.

**For Federal, State and County Prisons**

Here the problem is the crowding together of persons, many of whom come from lower socioeconomic strata where prevalence of tuberculosis remains relatively high even today. First and foremost, those with disease and healthy reactors must be identified in the admission procedures and treated in accordance with the guidelines of the ATS, which means that all healthy reactors under the age of 35 would be treated. Healthy reactors over the age of 35 should be treated if there are additional risk factors present, such as a history of recent exposure, significant scars seen on x-ray film, diabetes, gastrectomy, etc. Otherwise, healthy reactors over age 35 should be examined by x-ray annually while in prison and whenever pulmonary symptoms develop. Routine periodic skin testing of nonreactors need not be done unless an active case develops from whom transmission may occur. Then the converters must be treated prophylactically. In some prisons, the number of persons needing treatment may be so great that the administration of daily INH is impractical. In this case, there is good reason to believe that administration of a larger dose of INH (900 mg for adults) twice a week would be equally effective and safe. Tuberculosis control for city jails is impractical because of a turnover every few days, but the short stays preclude prolonged exposure.
For Nursing Homes and Mental Hospitals

The biggest reservoir of tuberculous infection is in elderly persons, which means that they can develop active tuberculosis at any time. In addition to the desirability of detecting and treating disease in individual patients, the possibility of transmission to personnel and other patients must be considered. Control measures should be different for patients and personnel, because their risks are different.

Patients. Identification of those who harbor the infection at the time of admission is important because it is among them that sporadic recrudescence of old infection may occur. This can be done by incorporating a routine PPD-T skin test as part of the admission routine performed by nursing personnel. Those negative on the initial 5 TU test should be re-tested in one to two weeks to detect persons in whom the first test produced a booster effect to be detected by the second test using the same strength of PPD. All reactors should be examined by chest x-ray to look for active disease and also significant scarring from dormant disease as an indication for prophylactic therapy. Reactors who are not treated should have a notation made on the front of the chart along with other important information such as allergies to medications, the presence of glaucoma, etc., in order to heighten awareness of the possibility of tuberculosis if pulmonary symptoms should develop. Whenever a reactor develops pulmonary symptoms he/she should be examined by x-ray and sputum specimens submitted for culture of tuberculosis. In addition, the knowledge that a patient is infected with M tuberculosis should cause the physician to give thought to tuberculosis at the time of each semi-annual physical evaluation and to obtain x-ray films and sputum specimens if there is the slightest suspicion of recrudescence of the dormant infection.

Personnel. Here the principal risk is of contracting the infection from inadvertent exposure to undetected tuberculosis among the patients. Each new employee should be tested with PPD-T and a record kept. Healthy reactors should be considered for prophylactic therapy in accordance with ATS guidelines. Nonreactors should be skin tested annually and converters treated prophylactically with INH if the x-ray film shows no disease, or two drugs if there is disease. Older healthy reactors should be examined by chest x-ray whenever pulmonary symptoms or loss of weight develop.

For Hospitals

Detection of unsuspected tuberculosis among patients is best accomplished by obtaining a chest x-ray film as a routine on all admissions of patients over the age of 60, and submission of sputum for smear and culture on all persons who have manifest pulmonary symptoms even though probably due to other causes. I recognize that the American College of Physicians and Blue Cross-Blue Shield have recently recommended against the routine chest x-ray examination, but I submit that such a policy will result in an increase in undetected pulmonary tuberculosis and increased risk of exposure of tuberculin-negative personnel. Employees should follow the procedures outlined for nursing home employees, because of the possibility of inadvertent exposure to undetected tuberculosis.

For “Colonies” of Retarded Persons

All new admissions and employees should be tested with PPD-T and a record kept of the results. Reactors should be examined by chest x-ray and prophylactic therapy given in accordance with ATS guidelines. Tuberculin-positive employees who are not so treated should have chest x-ray examinations whenever pulmonary symptoms develop but no less often than annually, in order to detect active disease before transmission occurs.

For Employees of Ordinary Public and Parochial Schools

Each new employee should be tested with PPD, reactors examined by x-ray and prophylactic INH given according to ATS guidelines. In areas of low prevalence there is no need to retest nonreactors annually, but reactors who are not treated should receive annual x-ray examinations to detect unsuspected recrudescence of infection before transmission occurs. School personnel who have a history of tuberculous disease should also be required to submit a sputum annually for smear and culture as an additional precaution.

In summary, it appears likely that tuberculosis will remain an endemic infection in this country at least for the rest of this century. It can be effectively controlled if the program is tailored to the individual situation, particularly in institutions housing groups of persons in close quarters. Careful screening of close contacts of active cases remains the most productive activity for health departments, but attention to the particular circumstances in various institutions is also essential if small but tragic epidemics of tuberculosis are to be prevented.

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