Results of Screening for Tuberculosis in Foreign-born Persons Applying for Adjustment of Immigration Status

Raymond N. Blum, M.D.; Louis B. Polish, M.D.; Janet M. Tapy, A.N.P.; Barbara J. Catlin, R.N.; and David L. Cohn, M.D.

As part of the required screening process of illegal aliens applying for adjustment of status by the Immigration and Naturalization Service, 7,573 persons were evaluated for tuberculous infection by the Denver Department of Health and Hospitals from May 1987 through December 1988. Applicants were screened with tuberculin skin testing, chest radiographs, or both. Review of 6,520 charts that were available found that 4,840 applicants had tuberculin skin tests, of which 2,039 (42 percent) were ≥10 mm and 1,528 had further evaluation at the Denver Metro Tuberculosis Clinic. Seventy-five percent of the applicants were between the ages of 15 and 34 years, and 91 percent were from Mexico. Evidence of past or current tuberculous infection on chest radiograph was present in 273 (17 percent) and 16 (7 percent) had sputum cultures obtained that identified four new cases of active tuberculosis. Isoniazid preventive therapy (IPT) was recommended to 1,029 applicants, of whom 29 (3 percent) were 35 years of age or older; 716 (70 percent) completed at least six months of treatment. We conclude that there is a high prevalence of tuberculous infection in foreign-born persons applying for adjustment of immigration status, but a low prevalence of clinically apparent tuberculosis. This population is an excellent target for IPT, which can be achieved with good success. Proactive screening and preventive therapy is likely to significantly reduce tuberculosis reactivation and morbidity, prevent secondary infection of contacts, and be cost-effective.

(Chest 1993; 103:1670-74)

IPT = isoniazid preventive therapy

Tuberculosis is increasing in the United States. The steady decline in the incidence of tuberculosis in the United States that had begun at the turn of the century reversed in 1985.1,2 Reasons for this include increased incidence of coinfection with human immunodeficiency virus,3 an enlarging homeless population,4 and an influx of immigrants from areas with a high prevalence of tuberculous infection.5 In 1987, 24 percent of tuberculosis cases were reported in persons born outside the United States, of whom 16 percent were from Mexico.6

There is a large group of aliens who have resided in the United States illegally, with different demographics and potentially different epidemiologic characteristics than other immigrant populations. These individuals may have been in the United States for a significant period of time, but may have been reluctant to seek medical assistance for fear of deportation. In addition, there is a potential for migration and intermittent return to country of origin, especially Mexico. The prevalence of tuberculosis in this population is unknown, but it is likely that this group will be a significant source of new cases of tuberculosis.

The Immigration Reform and Control Act of 1986 provided for millions of illegal aliens to begin the process of legalizing their status and to become US citizens. It has been estimated that 3.5 million people nationwide may have been eligible for this program, with approximately 31,000 in Colorado.7

This program offered a unique opportunity to determine the prevalence of tuberculosis in a large population of foreign-born persons, to evaluate the effectiveness of a large-scale public health screening process, and to determine the ability to apply published guidelines for preventive therapy for tuberculosis.8,9 We report the results of our tuberculosis screening efforts and a program of preventive therapy for those persons applying for adjustment of illegal alien status seen in the Denver metropolitan area.

METHODS

Applicant Eligibility and Program Guidelines

Persons applying for adjustment of status with the Immigration and Naturalization Service under the Immigration and Nationality Act and the Immigration Reform and Control Act of 1986 (Public Law 99-603) were required to undergo screening for tuberculosis among other illnesses. Negative tuberculin skin tests and/or normal chest radiographs provided for immediate clearance (with respect to tuberculous infection). A positive skin test and a normal chest radiograph called for immediate clearance after the applicant was encouraged to seek further evaluation for possible preventive therapy. An applicant with a positive skin test and an abnormal chest radiograph or an abnormal chest radiograph alone underwent further evaluation for active tuberculosis.

FACILITIES

Denver Health and Hospitals is an integrated, public health care system that includes Denver General Hospital, community health...
facilities, and the Department of Public Health where the tuberculosis clinic for the Denver metropolitan area is located. The system provides short- and long-term care for a largely uninsured, minority, and/or medically indigent population. When the Immigration Reform and Control Act of 1986 was passed, many persons presented to this system to complete their medical evaluation. The initial screening sites were the eight community health clinics and the walk-in and pediatric clinics at Denver General Hospital. From May 11, 1987 until December 31, 1988 all persons seen at Denver Health and Hospitals with suspicion of tuberculosis or tuberculous infection (ie, abnormal chest radiograph, symptoms compatible with tuberculosis, and/or a positive tuberculosis skin test) were referred to the Denver Metro Tuberculosis Clinic for further evaluation and treatment.

Tuberculosis Screening and Treatment

Applicants could choose to be screened for tuberculosis with either a skin test or a chest radiograph. In most clinics, children and adults younger than 35 years old had tuberculosis skin tests, and if positive, chest radiographs. In general, adults 35 years or older were screened initially with a chest radiograph only,* although some were screened with a skin test only. Charts for persons younger than 15 years were available only if they had been referred to the tuberculosis clinic and therefore the prevalence of tuberculosis positivity in this group could not be determined accurately.

Tuberculin skin testing was performed by a nurse using a 0.1-ml intracutaneous injection of 5 tuberculin units of purified protein derivative (PPD, Connaught, Swiftwater, Pa). Skin test reactions were read 48 to 72 hours later and the size of induration was recorded. Applicants with chest radiographic evidence of, or clinical symptoms consistent with active tuberculosis had sputum specimens for acid-fast bacilli smear and culture obtained on three successive days. In the absence of a productive cough, sputum samples were obtained after induction with nebulized sterile water.

All applicants with either a positive PPD skin test (≥10 mm induration) or a suspicious chest radiograph were referred to the tuberculosis clinic. Any applicant with a suspicious chest radiograph or who had not been skin-tested received a PPD skin test in the tuberculosis clinic. All chest radiographs were reviewed by a physician skilled in the interpretation of radiographic findings of tuberculosis.

When isoniazid preventive therapy (IPT) was indicated by established guidelines, it was offered free of charge through the tuberculosis clinic. Patients were monitored for compliance and side effects by nurses. Applicants with a positive PPD skin test and normal chest radiograph (class 2) who were younger than 35 years of age or applicants with a positive PPD skin test and abnormalities on chest radiograph consistent with inactive disease (class 4), regardless of age, were offered IPT for at least 6 months as per clinic protocol. Patients 35 years of age and older receiving IPT and those undergoing treatment for active disease had baseline and periodic liver function tests. Compliance was monitored through follow-up evaluations and pill counts if necessary. Patients were usually given a 1-month supply of medication, although at the nurse's discretion this was occasionally extended.

RESULTS

From May 1987 through December 1988, a total of 7,573 applicants were screened. Of these, 6,520 (86 percent) had charts that were available for review. A total of 1,528 were referred to the Denver Metro Tuberculosis Clinic. The indications for referral included positive tuberculin skin tests in 1,293 (85 percent) and abnormal chest radiographs in 235 (15 percent). The vast majority (91 percent) of applicants were from Mexico. Persons from the Middle East, Europe, Central America, Africa, Southeast Asia, and South America each represented about 1 percent of total applicants.

Results of tuberculin skin testing were available for 4,840 of the 6,520 charts reviewed and are shown in Table 1. Over 75 percent of applicants screened were younger than 35 years and the ages of those referred to the tuberculosis clinic were similar to the total group screened. Overall, 42 percent of evaluable applicants were tuberculin positive. The rate of tuberculin positivity ranged from 36 percent in applicants from Europe and Canada, to 43 percent from Mexico, and to 58 percent in those from South America. There was an increase in prevalence with age. Of note is the large burden among those of child-bearing age (both men and women), with 36 percent of those 15 to 24 years of age being tuberculin positive and nearly 50 percent of those 25 to 34 years of age being tuberculin positive.

The distribution of skin test reactivity by age and chest radiograph findings is shown in Table 2. A high percentage (89 percent) of positive skin test reactions were seen in conjunction with normal chest radiographs.

The results of efforts to implement IPT are shown

Table 1 — Results of Tuberculin Skin Testing of Foreign-Born Persons by Age

<table>
<thead>
<tr>
<th>Age, yr</th>
<th>No. Evaluate (%)*</th>
<th>No. Skin Tested (%)†</th>
<th>No. Skin Test Positive (%)‡</th>
<th>Screened by Chest Radiograph Only (%)†</th>
<th>No. Referred to Tuberculosis Clinic (%)‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-24</td>
<td>2,568 (39)</td>
<td>2,351 (92)</td>
<td>847 (36)</td>
<td>217 (8)</td>
<td>496 (19)</td>
</tr>
<tr>
<td>25-34</td>
<td>2,345 (36)</td>
<td>2,035 (87)</td>
<td>964 (47)</td>
<td>310 (13)</td>
<td>641 (27)</td>
</tr>
<tr>
<td>35-44</td>
<td>961 (13)</td>
<td>276 (29)</td>
<td>129 (47)</td>
<td>685 (71)</td>
<td>166 (17)</td>
</tr>
<tr>
<td>45-54</td>
<td>386 (6)</td>
<td>116 (30)</td>
<td>66 (57)</td>
<td>272 (70)</td>
<td>89 (23)</td>
</tr>
<tr>
<td>55-64</td>
<td>190 (2)</td>
<td>46 (35)</td>
<td>25 (54)</td>
<td>84 (65)</td>
<td>39 (30)</td>
</tr>
<tr>
<td>&gt;65</td>
<td>43 (1)</td>
<td>16 (37)</td>
<td>8 (56)</td>
<td>27 (63)</td>
<td>12 (29)</td>
</tr>
<tr>
<td>Total</td>
<td>6,520$</td>
<td>4,840</td>
<td>2,039 (42)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Represents percent of total evaluable.
†Represents percent of age group.
‡Positive ≥ 10 mm of induration to tuberculin skin test.
§Includes 85 children <15 years of age, on whom data were available only in those referred to tuberculosis clinic.
||Represents percent of total skin tested.

CHEST / 103 / 6 / JUNE, 1993
The cost on personnel, $209,000, of which 50 percent was expended on laboratory, and only 2 percent on medications. The cost per patient who completed IPT was approximately $285.

Review of our tuberculosis clinic records for three years following this screening program identified four additional cases of active tuberculosis in persons who had undergone the program. The patients were 29 to 51 years of age; three were from Mexico and one was from Guatemala. Three patients developed pulmonary disease and one developed lymphatic tuberculosis. All had normal chest radiographs at the time of screening. The patient with extrapulmonary disease developed cervical lymphatic tuberculosis two months post partum after deferring IPT during pregnancy. The 51-year-old man died of massive hemoptysis two years after screening, with evidence of pulmonary tuberculosis at autopsy. In vitro testing confirmed all cases of tuberculosis were due to fully susceptible organisms.

**DISCUSSION**

The prevalence of tuberculous infection and the effectiveness of a screening and prevention program of foreign-born persons applying for adjustment of immigration status has not been reported (to our knowledge). We found a high prevalence (42 percent) of tuberculous infection in this population, of whom 91 percent were from Mexico. Of the candidates for preventive therapy who were identified, 70 percent completed at least six months of therapy. Thus, this was a worthwhile screening program that will likely decrease the overall burden of tuberculosis in the future.

The 70 percent rate of compliance with preventive therapy in our program was key to its success and was much better than our prior experience with Southeast Asian refugees in whom noncompliance was often noted in the first two months of therapy (unpublished data). An additional factor may have been that it was much easier to initiate and complete therapy when IPT was given for 6 months rather than the traditional 12 months. Also, patients may have been motivated because the program was associated with adjustment of immigration status. Since more than 90 percent of our patients were from Mexico, the generalizability of these findings to other groups may not be appropriate.
Through our screening efforts, we were able to successfully identify and complete IPT in nearly 700 persons of child-bearing age. This intervention should confer the additional benefit of preventing secondary cases among children of the foreign born. Minorities currently account for 80 percent of tuberculosis in children. We may have missed cases of active disease. We obtained sputum cultures on only a fraction (0.3 percent) of the total population screened. Thus, the prevalence of asymptomatic or tuberculin-negative active disease in this population remains unknown. A recent evaluation by Nolan and colleagues of the utility of sputum cultures in tuberculosis suspects found that only the presence of cough or a cavitary lesion on chest radiograph had significant predictive value, and both were present less than 50 percent of the time. They suggested that isoniazid as a single agent may cure a significant number of patients who are asymptomatic, have a stable chest radiograph, but are only culture positive. Hence, it may be more cost-effective to identify candidates for preventive therapy than to define every case of asymptomatic, active disease.

The cost-effectiveness of this screening program can be approximated. Estimates of the lifetime risk of reactivation for healthy persons who are skin test positive and have a normal chest radiograph vary from 0.5 percent in Denmark to nearly 5 percent in young, black American men. Assuming a reactivation rate in our population of foreign born of 5 percent, including some persons with abnormal chest radiographs, 140 new cases of tuberculosis could be expected to develop in the approximately 6,600 persons evaluated. Most studies show an efficacy of IPT of at least 50 to 90 percent. Combining an efficacy of 70 percent with our completion rate of 70 percent for IPT, we would expect to prevent 69 cases of reactivation. The overall cost of our program was approximately $209,000 or $3,000 per case of tuberculosis prevented, which compares favorably with a recent estimate of $1,800 to $8,800 to treat a case of active tuberculosis. This does not include the number of secondary cases prevented, the significant cost of the morbidity of active tuberculosis, or the costs of potentially severe disease in newborns and young children.

The efficacy of IPT may decrease in a population with a high prevalence of isoniazid resistance. However, rates of isoniazid resistance in cases from Mexico may be lower than those of Southeast Asians or Haitians. In a recent community-based survey, only 4 of 34 cases from Mexico were isoniazid resistant. The Advisory Committee for the Elimination of Tuberculosis has commented on the critical importance of preventive therapy to achieve that goal. In a review of our records of new active cases, we were able to identify four additional cases thus far who had been through this screening program. One of these cases possibly could have been prevented if screening policy had required a skin test for those younger than the age of 35 years rather than accepting a chest radiograph. Further longitudinal follow-up of this group may reveal additional cases of tuberculosis. Active surveillance for new cases that could be considered screening failures should be done with special attention to IPT failures, drug-resistant disease, and secondary cases in contacts of these individuals.

The Advisory Committee for the Elimination of Tuberculosis has also recently released new recommendations concerning foreign-born persons. Some of the problems of previous programs are addressed, including the failure to screen appropriately, failure to identify candidates for IPT, and misdiagnosis of tuberculosis. The new recommendations for aliens suggest skin test screening of all applicants and chest radiographs for those with positive results. These recommendations are clearly supported by our findings of a high prevalence of tuberculous infection and predominantly normal chest radiographs.

Tuberculosis is a preventable disease. Successful prevention requires access of patients to the health care system, adequacy of the screening tests, and appropriate use of preventive therapy. Screening of the foreign born is a cost-effective program likely to favorably influence tuberculosis morbidity in the future and to aid in achieving the goal of the elimination of tuberculosis.

ACKNOWLEDGMENTS: We gratefully acknowledge Ms. Audrey Martinez for assistance with chart reviews and data collection.

REFERENCES
1 Comstock GW. Epidemiology of tuberculosis. Am Rev Respir Dis 1982; 125:8-15
9 Centers for Disease Control. Screening for tuberculosis and tuberculous infection in high-risk populations. MMWR 1990; 39(suppl RR-9):1-12
10 Snider DE Jr, Rieder HL, Combs D, Bloch AB, Hayden CH,
Results of Screening for Tuberculosis of Immigrants (Blum et al)