BACKGROUND

The American Geriatrics Society recommends, in order to establish baseline information, the practice of initial two-step PPD testing for all nursing home (NH) residents. Residents who react to either the first or second PPD skin test represent a reservoir of latent tuberculosis (TB) and are at risk to develop reactivation TB. Those residents who do not react to two-step PPD testing are immunologically naive to TB and susceptible to primary tuberculosis infection. Some may be anergic.

THE BOOSTER PHENOMENON

In persons who had initial infection and skin testing many years in the past, skin test reactivity may wane. Repeat skin testing on admission to a NH will then show little or no reaction. However, the small dose of PPD used in skin testing may stimulate an anamnestic immune response. This is known as boosting: A second skin test in the NH may be positive. The booster phenomenon can usually be demonstrated within a week of the initial skin test and will persist for at least a year. The booster phenomenon is more common in the elderly. There is no evidence that repeated PPD administration will by itself produce a positive skin test.

If a NH resident is negative after a single PPD skin test on admission and is then positive when next tested 6 or 12 months later, the conversion may be due either to the booster phenomenon or to the intercurrent development of primary infection. This potential ambiguity will be minimized by two-step PPD testing, in which a second PPD test is made one to three weeks after the first if the first test is negative. Those who are positive because of boosting will thus be identified. Then, those who convert with subsequent testing can be assumed to be newly infected. Because of cost implications, the periodicity of routine follow-up single-step PPD testing in NH residents who have had baseline two-step PPD testing must be defined by each institution considering local issues and prevalence. Retesting of the nursing home population is required when a TB exposure situation or potential outbreak of tuberculosis is identified. The Advisory Council for the Elimination of Tuberculosis recommends testing for the booster phenomenon when subsequent TB testing in the high risk population is likely, as it would be for the nursing home population. The technical aspects of two-step PPD testing have been described in detail.

EPIDEMIOLOGY

Following a period of resurgence of tuberculosis that began in the mid 1980’s and peaked in 1992, the United States has reestablished control over the disease. From 1992 through 2000, the incidence of tuberculosis declined by 45%. In 2000, the TB incidence ratio was 5.8 cases/100,000 population, the lowest ever recorded in this country.

Tuberculosis, however, occurs with disproportionate frequency among the elderly. Elders living in communal settings such as nursing homes or other long-term care settings have a TB incidence rate approximately four times greater than the general population. The aggregate tuberculosis incidence rate for
nursing home residents is 1.8 times higher than the rate seen in elderly persons living in the community.\textsuperscript{31}

In several studies of patients entering NHs, the percentage of PPD reactors was 10\% to 40\%.\textsuperscript{2,4,5,32} Generally, the risk that a recent convertor will develop clinically active TB is highest in the first two years after conversion and then falls.\textsuperscript{3,6} However, in PPD reactors over the age of seventy years, the case rate of active TB among known reactors may increase greatly.\textsuperscript{7} The most prevalent risk factors in the nursing home for development of active tuberculosis were diabetes (42\%), being more than 10\% below ideal body weight (41.5\%), and alcohol abuse (13\%).\textsuperscript{32} After two-step testing, 60\% to 90\% of patients entering NHs are PPD negative and are, therefore, non-immune to new infection, although 5-10\% of non-reactors to PPD may be anergic. These patients are at risk of infection if exposed and of progression to clinically active TB if not then treated. Nonreactors are vulnerable even though many of them may have been PPD positive previously.\textsuperscript{27,8} Anergy, which may occur with active TB infection or other forms of immune suppression, accounts for very few nonreactors.\textsuperscript{9}

**CHOOSING A THRESHOLD**

Although PPD testing is imperfect, it has been shown to have considerable validity, even in thin-skinned older people.\textsuperscript{5} Variability in PPD solution, its administration and the measurement of reaction is significant.\textsuperscript{16} Therefore, caution is needed in the interpretation of small changes in the size of a reaction. Many clinicians recommend the “ball-point pen” measurement technique of Sokal (movement of a pen toward the site of a PPD injection from two opposite sides and measurement of the distance between the points where the pen was stopped by induration).\textsuperscript{20} Cross-reactivity with nontuberculous mycobacterium (NTM) is problematic.\textsuperscript{17} Therefore, history of contact, clinical picture and regional prevalence of TB and NTM should all affect the clinician’s choice of a PPD threshold for reactivity.\textsuperscript{4,18,24-27} The Centers for Disease Control has published guidelines for threshold definition, screening in high risk populations and recommendations for prevention.\textsuperscript{24-27}

The decision to treat should consider, in addition to the skin test, clinical picture, and chest x-ray findings, an ethical balance of the individual resident’s best interests and the interests of the community.

**CONCLUSION**

NHs bring a relatively large population of patients infected with TB into close contact with an even larger population who are highly susceptible to infection. Several reports demonstrate endemic and epidemic new TB infection among NH residents.\textsuperscript{2,4,5,9} The diagnosis of TB may be difficult.\textsuperscript{10,11} Initial two-step PPD testing will more accurately identify residents who are immunologically naive to TB. If these patients subsequently become skin-test positive, they are at increased risk of developing clinically active disease. Defining a threshold for PPD positivity and deciding whether to treat are complex issues that require institutional and patient-specific judgment. Many states require, unless specifically contraindicated, that all nursing home residents receive 2-step PPD testing upon admission, and, if negative, surveillance would be done with a single-step test periodically thereafter. The American Geriatrics Society recommends that all states adopt such regulations.

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