ALTHOUGH THE INFECTIOUS ETIOLOGY OF TUBERCULOSIS WAS
determined over a century ago, a highly effective strategy for preventing this age-old disease has been elusive. Robert Koch, after identifying the etiology of tuberculosis, tried and failed to produce an effective vaccine; his efforts discredited him and nearly ruined his career. Subsequently, the Bacille Calmette-Guérin (BCG) vaccine was developed by attenuating a strain of *Mycobacterium bovis*, and it has been in wide use since 1921 (1). Whereas BCG is the oldest vaccine in use today, its efficacy has been imperfect. With the recent emergence of infections with multiply antibiotic-resistant strains of *Mycobacterium tuberculosis* and the risk of overwhelming disease in patients with AIDS, renewed attention has been focused on optimizing preventative strategies. These Infectious Disease Notes briefly summarize the current state of knowledge about BCG and provide recommendations for the use of BCG in children.

BCG was derived by multiple in vitro passages of *M. bovis*. The vaccine has been distributed worldwide, and its efficacy, which has been reported to vary from 0 to 80% (1,2), may vary from one preparation to another (2). A recent meta-analysis with a subset analysis of newborn and infant immunization demonstrated that the overall protective rate is about 50%, with 71% protection against death and 64% against meningitis (3,4). The reason for the wide variation in estimates of protectiveness among studies has been hotly debated, but appears to be related to the geographical latitude of the recipient and to the incidence of tuberculosis in the target group (5).

Whereas BCG vaccination has been instituted globally for about 75 years, many concerns about its use persist. Its efficacy is far below what is expected of other widely used vaccines, such as those for prevention of oral poliomyelitis or *Haemophilus influenzae* type b. No method is available for assessing protective immunity: skin test reactivity to purified protein derivative (PPD) of tuberculin is notoriously unreliable; the duration of protection following BCG administration is unknown; and its administration eliminates the utility of skin testing with PPD for the diagnosis of tuberculosis. Furthermore, since it is a live bacterial vaccine, it is contraindicated in immunodeficient individuals (particularly those with defects in cell-mediated immunity), and in people with extensive thermal injury or other serious skin diseases. Mild adverse effects including ulceration at the site of inoculation, muscle soreness and regional lymphadenitis are common. More serious complications including dissemination in immunocompromised hosts (such as infants with severe combined immunodeficiency) and osteitis are rare.

Optimal control of tuberculosis requires a multifaceted approach, in which vaccination is but one component. Other critical measures include early identification and treatment of active cases, use of preventative chemotherapy in those with inactive infection and the institution of aggressive infection control measures in environments where the organism is likely to spread, such as hospitals and residential communities. BCG vaccination should be considered only when exposure to tuberculosis is unavoidable and when other infection control measures are unlikely to succeed in preventing new cases. Since infants and children are at particularly high risk of developing extrapulmonary tuberculosis, they are natural candidates for BCG vaccination if their exposure to others with active disease is unavoidable. Furthermore, BCG only has to be given once and it may be administered at any time (including the neonatal period).

BCG vaccination of infants and children should be limited to certain high risk groups (such as aboriginal Canadians living on reserves [6]) and is recommended for the following (7):

- those from groups with a high rate of new infections
when other control strategies have proven to be ineffective;

- infants whose mothers have infectious tuberculosis and who are at high risk for becoming infected, either because of poor maternal compliance with antituberculosis medication or because prophylaxis of the infant cannot be assured; and

- those repeatedly exposed to others with untreated or incompletely treated tuberculosis.

**BCG** may be given to newborn infants irrespective of their tuberculin reactivity, but it should be withheld from older infants and children until they are found to be nonreactive to PPD. Since BCG is a live bacterial vaccine, care must be exercised to assure viability; it should be protected from light and heat and used within 8 h of reconstitution.

**REFERENCES**


David P Speert MD
Division of Infectious and Immunological Diseases
Department of Pediatrics, University of British Columbia and British Columbia’s Children’s Hospital, Vancouver, British Columbia