Vaccine Development

Acute Respiratory Infections and Child Survival: Potential Role of Pneumococcal Vaccine Control*

Together with diarrheal diseases and malnutrition, acute respiratory infections (ARIs) are the main causes of preventable death in children in developing countries. The problems of diarrhea and malnutrition are being addressed through various programs. Now more attention is being focused on finding a solution for ARIs.

Respiratory infection can be caused by any one of over 300 vi ruses and bacteria. This group of infections includes influenza, measles, diphtheria, pertussis, respiratory tuberculosis, sinusitis, acute otitis media, and pneumonia.

According to data from a few community-based longitudinal stud ies, ARIs are very common in children. A child living in an urban area will average 5-8 bouts per year during the first 5 years of life. The incidence is similar in developed and developing countries.

However, there are big differences in the rates and severity of lower respiratory tract infections, particularly pneumonia, between children in developed and developing countries. While children in developed countries may have more upper respiratory infections, children in developing countries appear to have at least twice as many lower respiratory tract infections. Their risk of dying from respiratory diseases may be 11 to 50 times greater than an American or Canadian child. WHO says that bacterial pneumonia and bronchopneumonia, either as a primary infection or as a complication of viral infection, are by far the most frequent causes of mortality from ARI in developing countries. Pneumococcal infections are generally the most frequent cause of bacterial pneumonia and bronchopneumonia.

Papua New Guinea Studies.

Measles, pertussis, BCG, and diphtheria vaccines certainly prevent many infections, but immunization against other ARIs is generally unavailable. Polyvalent pneumococcal vaccines are not currently advocated by WHO for use in infants and young children. However, new results from three field trials of pneumococcal capsular polysaccharide vaccines in Papua New Guinea suggest that they may decrease child mortality from acute lower respiratory tract infections (ALRI).

Acute respiratory infections are the main cause of child mortality in this large island north of Australia. The first controlled trial of a pneumococcal vaccine, conducted in Tari, suggested that it could prevent such deaths. That trial was quite small, however.

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Two double-blind, randomized, controlled trials were conducted with a larger population. Two Merck, Sharp & Dohme vaccines--Pneumovax (containing 14 capsular serotypes) and Pneumovax 23 (containing 23 capsular serotypes)--were tested in the Asaro Valley and the Tari basin. The goal was to vaccinate children 6-59 months of age and to revaccinate 1 year later. A total of 6,349 children entered the two trials; 758 received a second vaccination.

The efficacy of the vaccines against ALRI as the sole cause of death was estimated at 59% in children vaccinated when younger than 5 years ($p=0.008$) and 50% in children vaccinated when younger than 2 years ($p = 0.043$).

Mortality from all causes decreased 19% in the vaccinated group. ALRI was the sole cause of death in 29 children (31%) of total of 95 deaths from all causes in the placebo group. In contrast, ALRI accounted for only 12 of 78 deaths (15%) from all causes among the vaccinated group.

These studies provide further indications that pneumococcal vaccines may be useful components of ARI programs, especially for children 6 months of age and older, in some developing areas.

Role of Primary Health Care Programs.

Aside from the development of effective vaccines, WHO stresses the importance of a carefully managed primary health care (PHC) program to address the problem of ARI. A main ingredient of such programs is provision of standardized, clear instructions for PHC workers and semi-literate parents. Instructions must detail appropriate treatment of ARI, including antimicrobial therapy, and referral to higher levels of care. Supportive treatment at the PHC level also plays an important role in reducing mortality.

The PHC program should encourage community education to promote breast-feeding, reduce parental smoking, recognize the causes and cures for ARI, and use available vaccines against diseases such as tuberculosis and measles.

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