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INFECTIOUS DISEASES BOARD REVIEW MANUAL

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Vaccination

Series Editor:

Stephanie Nagy-Agren, MD

Assistant Professor of Internal Medicine, University of Virginia

School of Medicine, Charlottesville, VA

Chief, Division of Infectious Diseases, Veterans Affairs Medical Center, Salem, VA

Contributing Author:

Linda A. Waggoner-Fountain, MD

Assistant Professor of Clinical Pediatrics, University of Virginia School of Medicine, Charlottesville, VA

Table of Contents

Introduction	2
Case Presentation	2
Required Childhood Vaccinations	2
Other Available Vaccinations	9
Case Follow-up	10
Conclusion	10
References	11

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Vaccination

INTRODUCTION

Since the time of Edward Jenner more than 200 years ago, vaccination has been used to control the outbreak of certain diseases throughout the world. Today, vaccines are routinely administered to prevent major diseases such as smallpox, diphtheria, tetanus, pertussis, poliomyelitis, *Haemophilus influenzae* type b (Hib) infection, measles, mumps, and rubella. In the case of smallpox, the dream of eradication has become a reality worldwide. Poliomyelitis originally was targeted by the World Health Organization for total eradication by the year 2000. Although this date was not met, the goal is within reach. Vaccines directed against hepatitis B, pneumococcal infection, and influenza have made major headway in controlling these diseases, although much remains to be accomplished—even in developed countries.

This review will discuss the use of vaccines in 2001 and beyond.

CASE PRESENTATION

A family who has recently moved to the area comes to a local clinic for immunization advice after the child of a neighborhood friend died of pertussis during a community-wide outbreak. The children in this family are age 15 months, 5 years, and 8 years and have never received any vaccinations. The parents have not updated their vaccinations in over 10 years. The father is a telephone repairman, and the mother works as a part-time waitress in a local restaurant. After the loss of their friend's child, the parents are concerned about their children's and their own health.

REQUIRED CHILDHOOD VACCINATIONS

Vaccines that most states require children to receive before entering licensed child-care facilities or public school in the United States include diphtheria-tetanus toxoids with acellular pertussis (DTaP), poliovirus, measles-mumps-rubella (MMR), hepatitis B, Hib, and varicella. Many adults in military service or who work in the fields of health care, food service, education, or public service may be required or strongly encouraged

to update some of their former vaccinations (eg, Td, MMR, hepatitis B) and to receive yearly vaccination against influenza. Recommendations regarding standard immunization for children and adults that have been endorsed by the American Academy of Pediatrics (AAP), the Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC), and the American Academy of Family Physicians are noted in **Tables 1** and **2**.^{1,2}

Health providers must be familiar not only with recommended vaccination schedules but with the potential benefits and risks of individual vaccines in order to properly advise patients (and parents) about their use. Each vaccine has potential limited adverse effects (eg, local site reaction, fever) as well as the risk of rarer serious adverse effects (eg, anaphylaxis). Specific adverse effects of particular vaccines include localized or limited vesicular rash (varicella vaccine), thrombocytopenia (MMR vaccine), and febrile seizure (diphtheria-tetanus-pertussis [DTP] and measles vaccines); many clinicians recommend acetaminophen administration at the time of vaccination to prevent febrile seizure.

DIPHTHERIA

Diphtheria is a bacterial respiratory infection caused by *Corynebacterium diphtheriae*, a gram-positive bacillus. The major manifestation of diphtheria is membranous inflammation of the upper respiratory tract, usually involving the pharynx but sometimes involving the posterior nasal passages, larynx, and trachea. The exotoxin produced by *C. diphtheriae* also can induce widespread damage to other major organs, including the myocardium, central nervous system (CNS), and kidneys.

By injecting sublethal or inactivated broth cultures of diphtheria toxin into guinea pigs, Emil Behring in the late 1800s produced antisera that subsequently prevented death in nonimmune animals challenged with the virulent organism.³ Behring named his preparation *antitoxin* and received the Nobel Prize in 1901 for its discovery.³ In the early 1920s, Gaston Ramon showed that diphtheria toxin, when treated with heat and formalin, lost its toxic properties but retained the ability to produce serologic protection against the disease,⁴ thus creating the first toxoid. Widespread vaccination against diphtheria began in the United States in 1914 and has continued, providing protection against diphtheria to approximately 85% of recipients of the vaccine.⁵