

# PEDIATRIC PHARMACOTHERAPY

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## **Immunizations for Adolescents** **Marcia L. Buck, Pharm.D., FCCP**

**A**lthough more attention is often given to the immunizations required for school entry, there are several important opportunities for disease prevention by vaccination in adolescents. In accordance with the observation of National Immunization Awareness Month, this issue of *Pediatric Pharmacotherapy* will review the immunizations recommended for teens. In addition to routine immunizations, the role of meningococcal vaccine in the college-bound patient and the growing use of the pneumococcal and influenza vaccines will be addressed.

### Catch-up Immunizations

The Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics, and the American Medical Association recommend that immunization status be reviewed during a routine adolescent visit at 11-12 years of age.<sup>1</sup> This visit provides health care providers with the opportunity to educate patients on the importance of booster immunizations, identify any missed doses or documentation, and plan for future needs such as requirements for college attendance or international travel.

Administration of those vaccines which have been added to the routine childhood immunization schedule during the past decade may be undertaken or initiated at this visit in order to provide "catch-up" coverage. Currently, both hepatitis B and varicella vaccines are recommended for catch-up immunization in adolescents.<sup>1-4</sup>

### *Hepatitis B Vaccine*

Routine immunization of infants with hepatitis B vaccine began in the United States in 1991. Although the positive impact of this program on reducing overall disease burden is already being observed, it has not provided protection for older children. Most people who acquire hepatitis B are infected during adolescence or as young adults. Targeting the adolescent population for

catch-up vaccination has been the next logical step in creating a more fully protected citizenry.

In 1995, the ACIP published a recommendation that all children born prior to 1991, or those who were unable to receive the vaccine in infancy, be immunized with the complete series beginning at the 11-12 year visit.<sup>4</sup> Compliance with this recommendation has gradually improved. In a study of records from three health maintenance organizations, the rates of completed hepatitis B vaccination in 13 year olds were 26.1%, 50.4%, and 5.5% in 1996. Reassessment two years later showed improvement, to rates of 43.4%, 65.5%, and 25.7%, but coverage was still less than optimal.<sup>5</sup>

Because of the continued difficulty in improving adolescent immunization rates, additional attempts are being made to target those patients requiring catch-up immunization. At this time, 35 states, as well as the District of Columbia, require proof of hepatitis B immunization prior to entrance into middle school. The Commonwealth of Virginia mandated hepatitis B immunization prior to middle school attendance in 2001.<sup>6</sup> In addition to school-based requirements, several institutions have developed successful community immunization campaigns. A program targeting at-risk Vietnamese-American children in Dallas and Houston significantly increased immunization rates as well as family awareness of the risk for disease and need for prevention.<sup>7,8</sup>

For adolescents requiring hepatitis B immunization, a three-dose series is recommended, with a minimum of 4 weeks between the first two doses and two months between the second and third doses. Interruption of the series for a longer period does not require the administration of additional doses. The ACIP considers the available hepatitis B vaccine products (Recombivax HB<sup>®</sup> and Engerix-B<sup>®</sup>) to be interchangeable when using the three-dose

series.<sup>9</sup> An alternative two-dose series may be used with the adult dose of Recombivax HB® (10 mcg) for patients 11 to 15 years of age.<sup>10</sup>

#### *Varicella Vaccine*

Although now a part of the routine childhood series, most adolescents have not received the varicella vaccine. The vaccine may be of value in those who have not acquired natural immunity. Varicella infection in older adolescence and adulthood is associated with a higher incidence of complications, including death, than infection during childhood.

The ACIP recommends that the varicella vaccine (Varivax®) be administered to adolescents who have not been previously vaccinated or lack a reliable history of having contracted chickenpox. If the vaccine is given at the 11-12 year visit, a single dose of the vaccine is adequate. Older adolescents and adults should receive two doses of varicella vaccine, given a minimum of 4 weeks apart. Patients who are pregnant or may become pregnant within the next month and those who are immunocompromised should not receive the varicella vaccine.<sup>1-4</sup>

#### Routine Booster Immunizations

##### *Tetanus-Diphtheria (Td) Vaccine*

After the initial diphtheria-tetanus-acellular pertussis (DTaP) series has been completed at the 4-6 year visit, patients should continue to receive periodic boosters of both diphtheria and tetanus toxoids, using the Td vaccine. The Td product contains the same amount of tetanus toxoid as the DTaP vaccine, but only 1/3 to 1/10<sup>th</sup> of the diphtheria toxoid. The timing of the first dose of Td vaccine has recently been changed from 14-16 years to 11-12 years, in order to promote the adoption of a regularly scheduled visit at that time. As before, a booster dose of Td is recommended every 10 years thereafter. As in adults, Td vaccine should be administered to any adolescent who has an injury which might place him/her at risk for tetanus and has not been vaccinated within the last 5 years.<sup>1-4</sup>

##### *Measles-Mumps-Rubella (MMR) Vaccine*

The current recommendations for the MMR series specify administration at the 15-18 month and 4-6 year visits. The second dose was previously recommended for the 11-12 year visit; however, missed visits often resulted in inadequate immunization. Patients who were not immunized at the 4-6 year visit should receive their second dose of MMR at the 11-12 year visit. Immunocompromised adolescents or females who are pregnant or likely to become pregnant with the next 3 months should not be given the MMR vaccine.<sup>1-4</sup>

#### Meningococcal Vaccine

In June 2000, the ACIP published new recommendations on the prevention and control of meningococcal disease.<sup>11</sup> The authors quoted a disease incidence of 2,400-3,000 cases per year, with a 10% mortality and a 11 to 19% incidence of permanent sequelae in survivors (including neurologic disability, limb loss, and hearing loss). While the majority of cases occur during infancy, the second most frequently affected age group are young adults between 18 and 23 years of age. College students, by virtue of their close living arrangements, are known to be at even greater risk.

A quadrivalent polysaccharide meningococcal vaccine (Menomune-A/C/Y/W-135®) is currently available in the United States. It is administered as a single dose and typically provides protective levels of antibody within 10 days. At this time, the ACIP does not recommend routine immunization of adolescents, but suggests that information be made available to all patients and their families so that an informed decision about immunization can be made.

Although a recent cost-benefit analysis failed to show significant benefit from routine administration of meningococcal vaccine to college students, this practice is becoming more widespread.<sup>12,13</sup> According to data from the Immunization Action Coalition, 21 states currently require that all incoming college students receive education about the potential risk for meningococcal disease and the availability of the vaccine.<sup>14</sup> Eight states, including Virginia, require proof of immunization or a signed waiver prior to attendance at any 4-year public institution.

While not yet recommended for routine administration, immunization may be useful in the control of meningococcal outbreaks, defined as three or more confirmed cases within a three month period. When used in mass vaccination programs, the vaccine has been well tolerated, with only mild adverse effects such as pain and redness at the injection site. Rare cases of hypersensitivity, seizures, and paresthesias, however, have also been reported.

A conjugate meningococcal vaccine is currently being used in the United Kingdom for routine immunization. It is anticipated that this vaccine will be available in the United States within the next two to four years. It is likely that the addition of this vaccine to the routine childhood immunization series will have a significant impact on the incidence of meningococcal disease in the future.<sup>11-13</sup>

### Recommendations for High Risk Patients

#### *Pneumococcal Vaccine (23-valent)*

Patients with chronic illnesses which place them at risk for infection should receive the 23-valent polysaccharide pneumococcal vaccine (Pneumovax 23® or Pnu-Immune 23®). The ACIP recommends that the following groups of adolescents receive the vaccine:

- patients with asplenia, including those with sickle cell disease
- patients with chronic renal dysfunction (such as nephrotic syndrome)
- patients with cerebrospinal fluid leaks
- patients with immunosuppression caused by disease (such as HIV infection) or medications (such as chemotherapy or transplant immunosuppression).<sup>1</sup>

Revaccination may be of benefit if more than 5 years have passed since initial immunization. The need for administration of the 23-valent vaccine in high risk patients who previously received the 7-valent conjugate vaccine has not yet been determined. If a patient requires both types of pneumococcal vaccine, the 7-valent conjugate vaccine should be administered first, with the 23-valent vaccine administered 6 to 8 weeks later.

#### *Influenza Vaccine*

In addition to the routine immunization series, the influenza virus vaccine is recommended annually for adolescents with recognized risk factors such as:

- chronic pulmonary disease (such as asthma)
- cardiovascular disease
- hemoglobinopathies (such as sickle cell disease)
- immunosuppression (such as HIV infection or medication-induced)
- chronic metabolic disease (such as diabetes)
- chronic renal dysfunction
- chronic aspirin therapy (when influenza infection may increase the risk for Reye syndrome)
- pregnancy (2<sup>nd</sup> or 3<sup>rd</sup> trimester only)
- residence in a chronic-care facility
- residence with persons at high-risk for influenza infection.<sup>1</sup>

The ACIP also encourages vaccination in healthy college students to minimize the spread of infection. For adolescents between 9 and 12 years of age, a single dose of the split virus product is recommended. For older teens, a single dose of either split or whole virus may be administered. As an alternative to the traditional inactivated (intramuscular) product, patients may now be immunized with FluMist®; the intranasal, live attenuated influenza vaccine approved by the

Food and Drug Administration in June 2003. In adults and children  $\geq 9$  years of age, a single 0.5 ml dose should be inhaled each year.<sup>1,4</sup>

#### *Hepatitis A Vaccine*

If not previously immunized, adolescents residing in or having frequent travel to areas where hepatitis A infection is prevalent should be vaccinated. The ACIP defines these areas as having 20 or more cases annually per 100,000 people during the years between 1987 and 1997. (or twice the national average infection rate). In addition, teens with chronic liver disease, those who receive clotting factors, or those are involved in high-risk behaviors should be vaccinated, regardless of location.<sup>1,4,15</sup>

For patients between 2 and 18 years of age, there are two hepatitis A vaccine products available, Vaqta® and the 720 EL.U. strength of Havrix®. Both are given as a two-dose series. The second dose of Vaqta® is given 6-18 months after the initial dose, and the second dose of Havrix® is given 6-12 months after the initial dose. For patients older than 18 years of age, higher strength preparations of these two products are available. In addition, there is a combination product with both hepatitis A and B vaccines (Twinrix®), which may be beneficial in some patients.

### Patient and Family Education

Several publications are available to provide adolescent patients and their families with more information about immunizations. The Centers for Disease Control and Prevention (CDC) provides information for teens on their National Immunization Program (NIP) website at [www.cdc.gov/nip/recs/teen-schedule.htm](http://www.cdc.gov/nip/recs/teen-schedule.htm). The Immunization Action Coalition provides a printable brochure on hepatitis B vaccines and a one-page flyer of immunizations for adolescents on their website at [www.immunize.org](http://www.immunize.org). In addition, the Children's Hospital of Philadelphia has developed a very useful website for teens which describes the benefit of vaccination and addresses common questions in this population. The website for this tool is [www.vaccine.chop.edu/teenagers.shtml](http://www.vaccine.chop.edu/teenagers.shtml). For updated information on the influenza vaccine, including the new intranasal product, the CDC has created a site at [www.cdc.gov/nip/flu/News.htm](http://www.cdc.gov/nip/flu/News.htm).

### Summary

While most families are aware of the requirement for completion of the childhood immunization schedule prior to school entrance, many are unfamiliar with the need for continued immunizations during adolescence. The 11-12 year visit is an ideal time to review and reinforce

the role of immunization in protecting adolescents and young adults from infectious diseases, as well as to administer any necessary booster doses and plan for future needs.

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## Pharmacology Literature Review

### Illicit Methylphenidate Use in College Students

The illicit use of methylphenidate among young adults continues to be a concern. The results of this Internet-based survey of University of Michigan undergraduates revealed that 3% of the respondents (57/2,250) had abused

methylphenidate during the past year. The majority of these students (79%) first tried methylphenidate in college, while 19% started in high school and 2% in junior high. Students who reported illicit methylphenidate use also had a higher rate of abuse of other substances, including alcohol. Teter CJ, Esteban S, Boyd CJ, et al. Illicit methylphenidate use in an undergraduate student sample: prevalence and risk factors. *Pharmacotherapy* 2003;23:609-17.

### Management of Nephrotic Syndrome

This article provide a concise review of the available pharmacologic options for the treatment of nephrotic syndrome in children. The authors review the use of corticosteroids, cytotoxic agents, and cyclosporine, as well as adjunctive therapies. Robinson RF, Nahata MC, Mahan JD, et al. Management of nephrotic syndrome in children. *Pharmacotherapy* 2003;23:1021-36.

### Promethazine for Steroid-induced Psychosis

The successful use of promethazine to reverse steroid-associated mania in a 2 year old is described in this case report. The patient developed acute psychosis after receiving methylprednisolone for graft-versus-host disease following bone marrow transplantation. After treatment with lorazepam failed to resolve the symptoms, a 0.5 mg/kg IV dose of promethazine was administered. Four doses were given over 24 hours, with complete remission of symptoms. In addition to their case, the authors provide a review of the use of phenothiazines for corticosteroid-associated psychosis. Ingram DG, Hagemann TM. Promethazine treatment of steroid-induced psychosis in a child. *Ann Pharmacother* 2003;37:1036-9.

### Formulary Update

There was no meeting of the Pharmacy and Therapeutics Committee in July.

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