

PCV7 Herd Immunity Covers Unvaccinated Infants

BY MICHELE G. SULLIVAN
Mid-Atlantic Bureau

The rate of invasive pneumococcal disease among U.S. infants younger than 2 months has declined by 43% since the introduction of the pneumococcal conjugate vaccine in the United States, even though these children are too young to have received the vaccine.

“These data are the first to suggest that

neonates and infants too young to receive PCV7 are benefiting from herd immunity,” said Dr. Katherine A. Poehling and her coinvestigators. “Although the exact mechanism of herd immunity is uncertain, one hypothesis is that vaccinated children are less likely to have nasal carriage of pneumococcus and hence have less pneumococcal transmission to their contacts.”

The biggest decrease occurred in black infants, among whom the rate of invasive

disease declined 71% from 1997 to 2004. The change was enough to eliminate the racial disparity in invasive pneumococcal disease between black and white infants, the authors said (JAMA 2006;295:1668-74).

Their population-based study examined rates of confirmed invasive pneumococcal disease in eight states among infants younger than 3 months, from 1997 to 2004.

During that time, there were 170 cases: 89 occurred in the 3 years before the

vaccine (PCV7) was introduced, 24 cases during the transition year (2000-2001), and 57 in the 3 years after the vaccine was introduced.

Among all infants younger than 3 months—some of whom would have received at least one dose of the vaccine—the mean rate of disease decreased 42%, from 12 per 100,000 to 7 per 100,000. The rate among infants younger than 2 months—those too young to receive any doses of the vaccine—declined 43%, from 7 per 100,000 to 4 per 100,000.

The largest change occurred among black infants, noted Dr. Poehling, of Vanderbilt University, Nashville, Tenn., and her colleagues.

In this group, the rate of invasive pneumococcal disease decreased 71%, from 17 per 100,000 to 5 per 100,000.

The precipitous drop in disease echoes that which occurred after the introduction of effective vaccines for other communicable diseases, said Dr. Matthew L. Boulton, professor of epidemiology and director of the preventive medicine residency program at the University of Michigan, Ann Arbor. The challenge now will be to continue reinforcing the importance of vaccination to parents who might hear conflicting messages.

“Paradoxically, the more successful we are in a public health intervention like this, the less people become willing to have their children vaccinated,” he said in an interview. This has to do both with misinformation about immunization side effects and complacency about the decrease in disease risk. “It’s critical to keep a positive message about the importance of immunization out in the public.”

Remind parents of how seriously communicable diseases once affected children’s health, and point out the risks of immunization complications in real terms. “Tell them how many millions of doses are given and how very, very few children have true complications,” he said. “It’s a very tiny number.”

The study also examined changes in the pneumococcal serotypes causing the infections. Serotypes resistant to antibiotics decreased 75% from 1998 (the first year of serotyping) to 2004. Antibiotic-susceptible serotypes also decreased, but to a lesser extent (50%).

The study found small increases in disease caused by two serotypes present in the pneumococcal conjugate vaccine (18C and 19F) and in disease caused by a few nonvaccine strains that were not present prior to the introduction of PCV7.

These changes are troubling, according to Moe H. Kyaw, Ph.D., and his associates, whose epidemiologic study arrived at sim-

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BRIEF SUMMARY

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Protopic®
(tacrolimus)
Ointment 0.03%
Ointment 0.1%

FOR DERMATOLOGIC USE ONLY
NOT FOR OPHTHALMIC USE

Rx Only
See boxed WARNING concerning long-term safety of topical calcineurin inhibitors

INDICATIONS AND USAGE

PROTOPIC Ointment, both 0.03% and 0.1% for adults, and only 0.03% for children aged 2 to 15 years, is indicated as second-line therapy for the short-term and non-continuous chronic treatment of moderate to severe atopic dermatitis in non-immunocompromised adults and children who have failed to respond adequately to other topical prescription treatments for atopic dermatitis, or when those treatments are not advisable.

PROTOPIC Ointment is not indicated for children younger than 2 years of age (see boxed WARNING, WARNINGS and PRECAUTIONS: Pediatric Use).

CONTRAINDICATIONS

PROTOPIC (tacrolimus) Ointment is contraindicated in patients with a history of hypersensitivity to tacrolimus or any other component of the ointment.

WARNINGS

WARNING

Long-term Safety of Topical Calcineurin Inhibitors Has Not Been Established

Although a causal relationship has not been established, rare cases of malignancy (e.g., skin and lymphoma) have been reported in patients treated with topical calcineurin inhibitors, including PROTOPIC Ointment.

- Continuous long-term use of topical calcineurin inhibitors, including PROTOPIC Ointment, in any age group should be avoided, and application limited to areas of involvement with atopic dermatitis.
- PROTOPIC Ointment is not indicated for use in children less than 2 years of age. Only 0.03% PROTOPIC Ointment is indicated for use in children 2-15 years of age.

Prolonged systemic use of calcineurin inhibitors for sustained immunosuppression in animal studies and transplant patients following systemic administration has been associated with an increased risk of infections, lymphomas, and skin malignancies. These risks are associated with the intensity and duration of immunosuppression.

Based on the information above and the mechanism of action, there is a concern about potential risk with the use of topical calcineurin inhibitors, including PROTOPIC Ointment. While a causal relationship has not been established, rare cases of skin malignancy and lymphoma have been reported in patients treated with topical calcineurin inhibitors, including PROTOPIC Ointment. Therefore:

- PROTOPIC Ointment should not be used in immunocompromised adults and children.
- If signs and symptoms of atopic dermatitis do not improve within 6 weeks, patients should be re-examined by their healthcare provider and their diagnosis be confirmed (see PRECAUTIONS: General).
- The safety of PROTOPIC Ointment has not been established beyond one year of non-continuous use.

(See boxed WARNING, INDICATIONS AND USAGE, and DOSAGE AND ADMINISTRATION).

PRECAUTIONS

General
The use of PROTOPIC Ointment should be avoided on pre-malignant and malignant skin conditions. Some malignant skin conditions, such as cutaneous T-cell lymphoma (CTCL), may mimic atopic dermatitis.

The use of PROTOPIC Ointment in patients with Netherton's Syndrome or other skin diseases where there is the potential for increased systemic absorption of tacrolimus is not recommended. The safety of PROTOPIC Ointment has not been established in patients with generalized erythroderma.

The use of PROTOPIC Ointment may cause local symptoms such as skin burning (burning sensation, stinging, soreness) or pruritus. Localized symptoms are most common during the first few days of PROTOPIC Ointment application and typically improve as the lesions of atopic dermatitis resolve. With PROTOPIC Ointment 0.1%, 90% of the skin burning events had a duration between 2 minutes and 3 hours (median 15 minutes). 90% of the pruritus events had a duration between 3 minutes and 10 hours (median 20 minutes). (see ADVERSE REACTIONS).

Bacterial and Viral Skin Infections

Before commencing treatment with PROTOPIC Ointment, cutaneous bacterial or viral infections at treatment sites should be resolved. Studies have not evaluated the safety and efficacy of PROTOPIC Ointment in the treatment of clinically infected atopic dermatitis.

While patients with atopic dermatitis are predisposed to superficial skin infections including eczema herpeticum (Kaposi's varicelliform eruption), treatment with PROTOPIC Ointment may be independently associated with an increased risk of varicella zoster virus infection (chicken pox or shingles), herpes simplex virus infection, or eczema herpeticum.

Patients with Lymphadenopathy

In clinical studies, 112/13494 (0.8%) cases of lymphadenopathy were reported and were usually related to infections (particularly of the skin) and noted to resolve upon appropriate antibiotic therapy. Of these 112 cases, the majority had either a clear etiology or were known to resolve. Transplant patients receiving immunosuppressive regimens (e.g., systemic tacrolimus) are at

increased risk for developing lymphoma; therefore, patients who receive PROTOPIC Ointment and who develop lymphadenopathy should have the etiology of their lymphadenopathy investigated. In the absence of a clear etiology for the lymphadenopathy, or in the presence of acute infectious mononucleosis, PROTOPIC Ointment should be discontinued. Patients who develop lymphadenopathy should be monitored to ensure that the lymphadenopathy resolves.

Sun Exposure

During the course of treatment, patients should minimize or avoid natural or artificial sunlight exposure even while PROTOPIC is not on the skin. It is not known whether PROTOPIC Ointment interferes with skin response to ultraviolet damage.

Immunocompromised Patients

The safety and efficacy of PROTOPIC Ointment in immunocompromised patients have not been studied.

Renal Insufficiency

Rare post-marketing cases of acute renal failure have been reported in patients treated with PROTOPIC Ointment. Systemic absorption is more likely to occur in patients with epidermal barrier defects especially when PROTOPIC is applied to large body surface areas. Caution should also be exercised in patients predisposed to renal impairment.

Information for Patients

(See Medication Guide)

Patients using PROTOPIC Ointment should receive and understand the information in the Medication Guide. Please refer to the Medication Guide for providing instruction and information to the patient.

What is the most important information patients should know about PROTOPIC Ointment?

The safety of using PROTOPIC Ointment for a long period of time is not known. A very small number of people who have used PROTOPIC Ointment have had cancer (for example, skin or lymphoma). However, a link with PROTOPIC Ointment has not been shown. Because of this concern, instruct patients:

- Do not use PROTOPIC Ointment continuously for a long time.
- Use PROTOPIC Ointment only on areas of skin that have eczema.
- Do not use PROTOPIC Ointment on a child under 2 years old.

PROTOPIC Ointment comes in two strengths:

- Only PROTOPIC Ointment 0.03% is for use on children aged 2 to 15 years.
- Either PROTOPIC Ointment 0.03% or 0.1% can be used by adults and children 16 years and older.

Advise patients to talk to their prescriber for more information.

How should PROTOPIC Ointment be used?

Advise patients to:

- Use PROTOPIC Ointment exactly as prescribed.
- Use PROTOPIC Ointment only on areas of skin that have eczema.
- Use PROTOPIC Ointment for short periods, and if needed, treatment may be repeated with breaks in between.
- Stop PROTOPIC Ointment when the signs and symptoms of eczema, such as itching, rash, and redness go away, or as directed.
- Follow their doctor's advice if symptoms of eczema return after treatment with PROTOPIC Ointment.
- Call their doctor if:
 - Their symptoms get worse with PROTOPIC Ointment.
 - They get an infection on their skin.
 - Their symptoms do not improve after 6 weeks of treatment. Sometimes other skin diseases can look like eczema.

To apply PROTOPIC Ointment:

Advise patients:

- Wash their hands before applying PROTOPIC.
- Apply a thin layer of PROTOPIC Ointment twice daily to the areas of skin affected by eczema.
- Use the smallest amount of PROTOPIC Ointment needed to control the signs and symptoms of eczema.
- If they are a caregiver applying PROTOPIC Ointment to a patient, or if they are a patient who is not treating their hands, wash their hands with soap and water after applying PROTOPIC. This should remove any ointment left on the hands.
- Do not bathe, shower, or swim right after applying PROTOPIC. This could wash off the ointment.
- Moisturizers can be used with PROTOPIC Ointment. Make sure they check with their doctor first about the products that are right for them. Because the skin of patients with eczema can be very dry, it is important to keep up good skin care practices. If they use moisturizers, apply them after PROTOPIC Ointment.
- What should patients avoid while using PROTOPIC Ointment? Advise patients:
 - Do not use ultraviolet light therapy, sun lamps, or tanning beds during treatment with PROTOPIC Ointment.
 - Limit sun exposure during treatment with PROTOPIC Ointment even when the medicine is not on their skin. If patients need to be outdoors after applying PROTOPIC Ointment, wear loose fitting clothing that protects the treated area from the sun. Doctors should advise what other types of protection from the sun patients should use.
 - Do not cover the skin being treated with bandages, dressings or wraps. Patients can wear normal clothing.
 - Avoid getting PROTOPIC Ointment in the eyes or mouth. Do not swallow PROTOPIC Ointment. Patients should call their doctor if they swallow PROTOPIC Ointment.

Drug Interactions

Formal topical drug interaction studies with PROTOPIC Ointment have not been conducted. Based on its extent of absorption, interactions of PROTOPIC Ointment with systemically administered drugs are unlikely to occur but cannot be ruled out. The concomitant administration of known CYP3A4 inhibitors in patients with widespread and/or erythrodermic disease should be done with caution. Some examples of such drugs are erythromycin, itraconazole, ketoconazole, fluconazole, calcium channel blockers and cimetidine.

Carcinogenesis, Mutagenesis, Impairment of Fertility

No evidence of genotoxicity was seen in bacterial (*Salmonella* and *E. coli*) or mammalian (Chinese hamster lung-derived cells) *in vitro* assays of mutagenicity, the *in vitro* CHO/HGPRT assay of mutagenicity, or *in vivo* clastogenicity assays performed in mice. Tacrolimus did not cause unscheduled DNA synthesis in rodent hepatocytes.

Reproductive toxicology studies were not performed with topical tacrolimus.

Pregnancy

Teratogenic Effects: Pregnancy Category C

There are no adequate and well-controlled studies of topically administered tacrolimus in pregnant women. The experience with PROTOPIC Ointment when used by pregnant women is too limited to permit assessment of the safety of its use during pregnancy.

There are no adequate and well-controlled studies of systemically administered tacrolimus in pregnant women. Tacrolimus is transferred across the placenta. The use of systemically administered tacrolimus during pregnancy has been associated with neonatal hyperkalemia and renal dysfunction. PROTOPIC Ointment should be used during pregnancy only if the potential benefit to the mother justifies a potential risk to the fetus.

Nursing Mothers

Although systemic absorption of tacrolimus following topical applications of PROTOPIC Ointment is minimal relative to systemic administration, it is known that tacrolimus is excreted in human milk. Because of the potential for serious adverse reactions in nursing infants from tacrolimus, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the mother.

Pediatric Use

PROTOPIC Ointment is not indicated for children less than 2 years of age.

Only the lower concentration, 0.03%, of PROTOPIC Ointment is recommended for use as a second-line therapy for short-term and non-continuous chronic treatment of moderate to severe atopic dermatitis in non-immunocompromised children 2 to 15 years of age who have failed to respond adequately to other topical prescription treatments for atopic dermatitis, or when those treatments are not advisable.

The long-term safety and effects of PROTOPIC Ointment on the developing immune system are unknown (see boxed WARNING, WARNINGS and INDICATIONS AND USAGE).

The most common adverse events associated with PROTOPIC Ointment application in pediatric patients were skin burning and pruritus (see ADVERSE REACTIONS). In addition to skin burning and pruritus, the less common events (< 5%) of varicella zoster (mostly chicken pox), and vesiculobullous rash were more frequent in patients treated with PROTOPIC Ointment 0.03% compared to vehicle. In the open-label safety studies, the incidence of adverse events, including infections, did not increase with increased duration of study drug exposure or amount of ointment used. In about 4,400 pediatric patients treated with PROTOPIC Ointment, 24 (0.5%) were reported with eczema herpeticum. Since the safety and efficacy of PROTOPIC Ointment have not been established in pediatric patients below 2 years of age, its use in this age group is not recommended.

Geriatric Use

Four hundred and four (404) patients ≥ 65 years old received PROTOPIC Ointment in phase 3 studies. The adverse event profile for these patients was consistent with that for other adult patients.

ADVERSE REACTIONS

No phototoxicity and no photoallergenicity were detected in clinical studies with 12 and 216 normal volunteers, respectively. One out of 198 normal volunteers showed evidence of sensitization in a contact sensitization study.

The following table depicts the adjusted incidence of adverse events pooled across the 3 identically designed 12-week controlled studies for patients in vehicle, PROTOPIC Ointment 0.03%, and PROTOPIC Ointment 0.1% treatment groups. The table also depicts the unadjusted incidence of adverse events in four safety studies, regardless of relationship to study drug.

Adverse Event	12-Week Randomized, Double-Blind, Phase 3 Studies				Open-Label Studies (up to 3 years)			
	Vehicle (n=20)		PROTOPIC Ointment (n=20)		Vehicle (n=40)		PROTOPIC Ointment (n=40)	
	Incidence (%)	95% CI	Incidence (%)	95% CI	Incidence (%)	95% CI	Incidence (%)	95% CI
Skin Burning†	26	46	58	29	43	28	20	24
Pruritus†	37	46	46	27	41	28	19	22
Flu-like symptoms†	19	23	31	25	28	22	34	28
Allergic Reaction	8	12	6	8	4	9	13	11
Skin Erythema	20	25	28	13	12	12	7	9
Headache†	11	20	19	8	13	9	11	11
Eye†	4	4	1	13	21	2	14	8
Infection	1	1	2	9	7	6	10	8
Cough Increased	2	1	1	14	18	3	13	6
Asthma	4	6	4	6	6	4	13	8
Herpes Simplex	4	4	4	2	0	4	3	3
Eczema Herpeticum	0	1	1	0	2	0	0	0
Pharyngitis	3	3	4	11	6	4	12	8
Accidental Injury	4	3	6	3	6	6	8	7
Pustular Rash	2	3	4	3	2	2	7	5
Folliculitis†	1	6	4	0	2	4	2	3
Rhinitis	4	3	2	2	6	2	4	3
Otitis Media	4	0	1	6	12	2	11	6
Sinusitis†	1	4	2	8	3	6	7	6
Diarrhea	3	3	4	2	5	2	4	3
Urticaria	3	3	6	1	1	3	4	4
Lack of Drug Effect	1	1	0	1	1	6	6	6
Bronchitis	0	2	2	3	4	4	4	4
Vomiting	0	1	1	7	0	1	4	3
Maculopapular Rash	2	2	2	3	0	2	1	1
Rash†	1	5	2	4	2	2	3	3
Abdominal Pain	3	1	2	3	1	2	1	2
Fungal Dermatitis	0	2	1	3	0	2	4	3
Gastroenteritis	1	2	2	3	0	2	4	3
Alcohol Intolerance†	0	3	7	0	0	4	0	2
Acid†	2	4	7	1	0	3	2	3
Suburn	1	2	1	0	0	2	1	1
Skin Disorder	2	2	1	1	4	2	2	2
Conjunctivitis	1	2	2	2	3	4	3	3
Pain	1	1	1	0	1	2	1	2
Vesiculobullous Rash†	3	3	2	0	4	2	1	1
Lymphadenopathy	2	2	1	0	3	1	2	1
Nausea	4	3	2	0	0	2	2	2
Skin Tingling†	2	3	8	1	2	2	1	1
Face Edema	2	2	1	2	1	1	1	1
Drysepia†	1	1	4	0	0	2	2	2

Dry Skin	7	3	3	0	1	1	1	1	1
Hypoaesthesia	1	3	7	0	0	2	0	0	1
Skin Itching	1	1	1	0	0	1	2	2	2
Back Pain	0	2	2	1	1	3	0	0	2
Pruritus Edema	2	4	3	0	0	2	0	0	2
Varicella Zoster†	0	1	0	0	5	1	2	2	2
Herpes Zoster†	1	3	3	3	4	2	2	2	2
Contact Dermatitis	1	2	3	0	0	1	0	1	1
Asthma	1	2	3	0	0	1	0	1	1
Pneumonia	0	1	1	2	0	1	3	2	2
Eczema	2	2	2	0	0	1	0	1	1
Insomnia	3	4	5	1	1	2	0	1	1
Exfoliative Dermatitis	3	3	1	0	0	0	1	0	1
Dysmenorrhea	2	4	4	0	0	2	1	1	1
Procedural Acceses	1	0	1	0	0	1	1	1	1
Dys†	0	3	2	0	0	2	1	1	1
Cyst†	0	1	3	0	0	1	0	1	1
Cellulitis	1	1	1	0	0	1	1	1	1
Exacerbation of Untreated Area	1	0	1	1	0	1	1	1	1
Procedural Complication	1	0	0						

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ilar conclusions regarding serotype changes after PCV7: Rates of invasive disease caused by antibiotic-resistant bacteria have declined, but rates of resistant disease caused by 19A increased by 238% from 1999 to 2004. The study also found modest increases in invasive disease caused by resistant strains not included in the vaccine (N. Engl. J. Med. 2006; 354:1455-63).

"The increase in resistant disease caused by serotype 19A is a concern," said Dr. Kyaw, of the Centers for Disease Control and Prevention, and his colleagues. "It is difficult to predict whether the increase in resistant serotype 19A or other serotypes not covered by the vaccine will continue. Nevertheless, this replacement disease has the potential to reduce the overall benefit of the vaccine against resistant infections."

Replacement disease with resistant strains, particularly 19A, is a surprise—and not a nice one, Dr. Daniel M. Musher said in an accompanying editorial. "This problem is compounded by the fact that,

through genetic transformation, pneumococci can switch capsules." If pneumococcal strains with pandemic potential, such as 6B, 9V, or 23F, acquire a resistant capsule, dangerous new types could emerge.

There is insufficient information to make any predictions about the endemic spread of these replacement serotypes, Dr. Boulton said. "We have seen only cases of disease being caused by these replacement strains, but that's all. It would be a very different situation if we begin to see levels of transmission comparable to what was seen in the serotypes included in the vaccine." ■

Pneumococcal Vaccine Stops hMPV Infection

Children vaccinated with three doses of pneumococcal conjugate vaccine had a reduced rate of human metapneumovirus-associated infections of the lower respiratory tract, as well as a lower rate of clinical pneumonia than children given placebo, researchers reported.

Dr. Shabir A. Madhi of the University of the Witwatersrand, Bertsham, South Africa, and colleagues performed an analysis of data from nearly 40,000 children—some of whom had been infected with HIV—who had been given three doses of a polysaccharide-protein conjugate vaccine (PCV) or placebo in an ongoing phase III study.

Dr. Madhi and coinvestigators tested nasopharyngeal aspirate samples of the children who had been hospitalized with lower respiratory tract infection (LRTI) for evidence of human metapneumovirus (hMPV), which was discovered only 5 years ago, as well as for HIV and C-reactive protein (J. Infect. Dis 2006;193:1236-43).

They found that for vaccinated children without HIV infection, the hospitalization rate was 46% lower than that of children who received placebo. For HIV-infected children, the reduction was 53% versus placebo. The incidence of clinical pneumonia also was reduced for both HIV-free and HIV-infected children who received vaccine (55% and 65%, respectively).


These results "suggest that bacterial coinfections, particularly pneumococcal infections, are an essential part of the pathogenesis of most severe hMPV infections progressing to pneumonia," they said. This means that children hospitalized with hMPV-associated pneumonia "should be treated with antibiotics."

—John R. Bell

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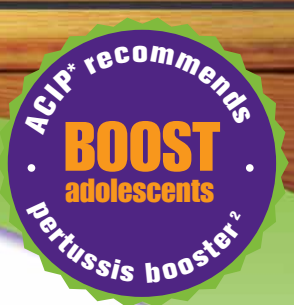
Pertussis immunity wanes in early adolescence¹



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In clinical studies, adverse events included pain, redness, and swelling at the injection site, headache, fatigue, and gastrointestinal symptoms. As with other vaccines, rare adverse events may occur. As with any vaccine, vaccination with BOOSTRIX may not protect 100% of susceptible individuals. Hypersensitivity to any component of BOOSTRIX is a contraindication.

*Advisory Committee on Immunization Practices.



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