REVIEWS

The Use of Vaccines in Adult Patients With Renal Disease

Mara Dinits-Pensy, MD, Graeme N. Forrest, MD, Alan S. Cross, MD, and Michael K. Hise, MD

• **In patients with renal disease, infection remains among the most common causes of morbidity and mortality. Alterations in the function of the immune system, as well as unique exposures of this patient population, account for the increased risk. Vaccination is an invaluable tool in preventing many infectious diseases. Unfortunately, responsiveness to vaccination in patients with renal disease can be diminished. In the present review, we examine the available evidence on the use of vaccinations in adult patients at different stages of chronic kidney disease. We address efficacy, clinical outcomes, and potential costs of individual vaccinations and provide our recommendations based on the literature reviewed. We also identify areas in which additional research is needed.** ***Am J Kidney Dis*** **46:997-1011.**

INDEX WORDS: Immunization; vaccine; renal disease; dialysis; renal transplantation.

INFECTION IS an important cause of death in patients with renal disease, ranking third after cardiovascular insults and miscellaneous events in patients on long-term dialysis. Patients with chronic kidney disease (CKD) are more likely to be hospitalized for bacteremia and/or septicemia than patients without CKD.[1] Six-month mortality in patients with CKD hospitalized with bacteremia is 10 times greater than that in patients without bacteremia and exceeds mortality for cardiovascular admissions, including acute myocardial infarction and congestive heart failure. Thus, it is imperative that we take advantage of all potential mechanisms to prevent infectious complications in patients with renal disease. Perhaps one of the easiest mechanisms is vaccine use. Unfortunately, many dialysis centers and nephrology practices are reluctant to administer vaccines, in part because of a lack of understanding regarding their risk-benefit profiles. In a pediatric survey, only 60% of facilities suggested that pneumococcal vaccine be administered.[2] Similarly, 10% to 15% did not recommend even standard killed vaccines for children with renal disease.[2] In renal transplant recipients, there have been theoretical concerns that vaccination may trigger rejection. These concerns have not been substantiated in the literature.

The most comprehensive source for information regarding vaccinations in all groups is the *Morbidity and Mortality Weekly Report* published by the Centers for Disease Control and Prevention (CDC).[3] These recommendations take into consideration published information from the Advisory Committee on Immunization Practices (ACIP), the American Academy of Family Physicians, the American College of Obstetricians and Gynecologists, and the American College of Physicians–American Society of Internal Medicine. Unfortunately, no concise guidelines designed specifically for immunization of patients at different stages of kidney disease are available.

Patients with renal disease represent a special population because of their immunosuppressed status and unique exposures. Multiple problems contribute to the increased risk for infectious complications in these patients, including the use of vascular access catheters, long-term peritoneal dialysis catheters, and immunosuppression after transplantation. Equally important are defects in immune function that are secondary to the uremic state per se. Various aspects of host defenses are affected by uremia and its metabolic consequences, including neutrophil function, antigen processing, antibody formation, and cell-mediated immune responses. Neutrophils show

From the Department of Medicine and Center for Vaccine Development, University of Maryland Medical Center, Baltimore, MD.

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Address reprint requests to Mara Dinits-Pensy, MD, Department of Medicine, Division of Nephrology N3W143, University of Maryland Medical System, Baltimore, MD 21201. E-mail: mdinits@medicine.umaryland.edu

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Table 1. Vaccinations for Patients on Renal Replacement Therapy

Vaccine	Administration and Schedule	Booster Doses	Contraindications and Precautions	Comments
Hepatitis B recombinant vaccine	Engerix, 40 μg IM at 0, 1, 2, 6 mo Recombivax, 40 μg IM at 0, 1, 6 mo	When anti-HBs titer $<$ 10 mU/L	Hypersensitivity to yeast, latex, or any component of the vaccine; multiple sclerosis	There must be 4 wk between doses 1 and 2 and 8 wk between doses 2 and 3 (Recombivax); brands may be used interchangeably
Influenza trivalent inactivated vaccine	0.5 mL IM annually, preferably in October or November	Not recommended	Hypersensitivity to eggs; latex allergy; acute febrile illness	Can be administered at the same time as pneumococcal vaccine; live influenza vaccine is not recommended
Streptococcus pneumoniae 23-valent polysaccharide vaccine	0.5 mL SC or IM	Revaccination 5 y after first dose	Hypersensitivity to any component of the vaccine; acute febrile illness; severely compromised cardiovascular or pulmonary function	May be administered at the same time as influenza vaccine; currently, revaccination after a second dose is not routinely recommended
Tetanus toxoid	Primary immunization: 3 doses of 0.5 mL of either tetanus toxoid or tetanus/diphtheria toxoid IM with 4-8 wk between doses 1 and 2 and 6-12 mo between doses 2 and 3	0.5 mL every 10 y	Hypersensitivity to thimerosal; neurological reactions to tetanus toxoid; acute febrile illness; latex allergy	In areas where diphtheria poses a risk, tetanus/diphtheria toxoid may be preferred to tetanus toxoid
Varicella live attenuated vaccine	0.5 mL (minimum, 1,350 PFU) SC; second dose of 0.5 mL 4-8 weeks later	Not recommended	Severe immunodeficiency, including immunosuppressive therapy, human immunodeficiency virus, leukemia, lymphoma, or other blood dyscrasias. Anaphylaxis to neomycin or hypersensitivity to any vaccine component including gelatin.	Not routinely recommended; consider for patients awaiting renal transplantation; recipients of vaccine may be capable of transmitting the vaccine virus to close contacts for up to 6 weeks
Hepatitis A inactivated vaccine	1 mL of Havrix or Vaqta IM into the deltoid	6-12 mo later	Hypersensitivity to any component of the vaccine, including neomycin; latex allergy; febrile illness	Not routinely recommended; administer to patients with chronic liver disease, traveling to endemic areas, with intravenous drug use and male patients who have sex with men

Abbreviations: IM, intramuscular; SC, subcutaneous.