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Loss of respiratory virus vaccine efficacy in the vitamin A deficient host

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Background: Acute respiratory virus infections are responsible for more than 4.5 million deaths each year and pneumonia is the leading killer of children. Vaccination is the best way to prevent viral infections, but many respiratory virus vaccine candidates have failed in clinical trials and licensed products are not fully protective. Improvements in these vaccination programs could have a profound positive influence on pediatric health. Because vitamin A deficiencies affect children worldwide and are known to influence the immune response, we questioned whether vitamin A deficiencies impaired the efficacy of an intransal influenza virus vaccine.

Methods: To gain a preliminary understanding of the influence of vitamin A deficiencies on intranasal respiratory virus vaccines, we placed pregnant C57BL/6 mice on vitamin A deficient or control diets at 4-5 days gestation. Progeny were maintained on the diets until adulthood and throughout the course of experimentation. Adult mice were vaccinated intranasally with a PR8-derived, cold-adapted influenza virus vaccine, after which immune responses were examined. Vaccinated animals were challenged with wildtype PR8 and tested for weight maintenance and survival.

Results: Unlike control animals, vitamin A deficient mice failed to develop a robust local influenza virus-specific IgA response, a correlate of protection and first line of defense against respiratory virus infection. When challenged with wildtype PR8, vaccinated, vitamin-replete animals were well protected. They maintained weight without morbidity throughout a 10 day course after challenge. In contrast, there was weight loss and death among vaccinated, challenged vitamin A deficient mice.

Conclusion: Data showed that protective immune responses induced by intranasal virus vaccines were impaired in the vitamin A deficient host. These data may explain, at least in part, the previous failures of candidate respiratory virus vaccines in clinical trials and the suboptimal protection conferred by licensed respiratory virus vaccines. Results encourage evaluation of correlations between vitamin levels and respiratory virus vaccine-induced immune responses in humans. The provision of vitamin supplements at the time of vaccination may ultimately improve vaccine-induced immune responses and help protect children from the morbidity and mortality caused by respiratory virus disease.

Biography

Hurwitz received her PhD from the Johns Hopkins University, Baltimore, MD and completed post-doctoral research with Drs. Peter Doherty and Walter Gerhard at the Wistar Institute, Philadelphia, PA. She then joined the Basel Institute for Immunology, Basel, Switzerland as a Member. She is currently a Full Member in the Department of Infectious Diseases at St. Jude, an adjunct Professor at the University of Tennessee, Memphis, and visiting Faculty in the Faculty of Health Sciences at Africa University, Mutare, Zimbabwe. Dr. Hurwitz's laboratory focuses on vaccine development and the translation of basic immunological concepts to improvements in pediatric healthcare.

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