

4th World Congress on Virology

October 06-08, 2014 Hilton San Antonio Airport, TX, USA

Skin immunization against rotavirus using microneedles

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Despite progress in the prevention of rotavirus following the introduction of rotavirus vaccines in middle income and developed countries, diarrheal disease remains a major killer among children in low-income countries of Africa and Asia. The lower efficacy of live oral vaccines, the need for a separate supply chain with large volume of cold storage, and the perceived concern about adverse events (e.g., intussusception) all point to the need for a second generation of parenteral vaccine. In our early studies, we demonstrated high immunogenicity and protective efficacy of an inactivated rotavirus vaccine (IRV) when formulated with aluminum adjuvant and administered intramuscularly (IM) in mice and gnotobiotic piglets. We recently assessed new technology to deliver rotavirus vaccine and demonstrated dose sparing and enhanced immunogenicity of IRV without adjuvant administered intradermally (ID) using a microneedle patch in mice. In the present study, we further assessed whether IRV without adjuvant when administered ID using a microneedle device MicronJet600® could induce protective immunity and confer protection in comparison with aluminum-adjuvanted IM-administered IRV in neonatal gnotobiotic piglets. Three doses of 5 µg IRV when administered by ID and 5 µg IRV formulated with 600 µg Al(OH)₃ when administered by IM induced comparable IgG, IgA, and neutralizing titers in serum of piglets. Both IRV immunization regimens protected piglets from oral challenge with a virulent human RV Wa strain, as evidenced by reduction in or lack of rotavirus antigen shedding in stool and lower mean diarrhea scores. By contrast, placebo-vaccinated piglets shed rotavirus antigen for up to 7 days or developed diarrhea. These findings demonstrate the immunogenicity and protective efficacy of IRV in a large animal model and further help establish the proof of concept for IM and ID immunization against rotavirus.

Biography

Jiang currently is a team lead/supervisory research microbiologist in Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, US Centers for Disease Control and Prevention. His research interests include epidemiology, virology, immunology and vaccinology of rotavirus and other agents of viral gastroenteritis, with a particular focus on research and development, and advocacy of rotavirus vaccines. He has served as an advisor and consultant for vaccine manufacturers, government and non government organizations in developed countries and emerging developing countries. Dr. Jiang obtained his DVM degree in China and PhD degree in virology from the Ohio State University, and received post-doctoral training with the National Research Council of the National Academy of Sciences at CDC. He has published more than 130 articles or book chapters in peer-reviewed scientific journals and holds several patents on rotavirus vaccine and diagnostics. He received a number of awards and honors, including the 2012 Excellence in Technology Transfer Award from the Federal Laboratory Consortium for "Heat Inactivated Rotavirus Vaccines" and the 2014 Honor Award from the Centers for Disease Control and Prevention for Excellence in Public Health Impact in supporting domestic rotavirus surveillance in the United States. He has served in various professional and community organizations, including ATCC Advisory Committee, editorial and review boards of scientific journals, and overseas Chinese communities. His other personal interests include travel, sports and gardening.

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