Evaluation of rotavirus vaccine effectiveness against G1 and G2 strains possessing a DS-1-like genetic backbone in Malawian infants

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Introduction: Despite introduction of rotavirus vaccines in many countries, rotavirus remains the major cause of severe gastroenteritis in children. Malawi introduced a Wa-like G1P[8] Rotarix human rotavirus vaccine (HRV) into its childhood immunisation schedule in 2012, reaching 95% coverage by 2015. Hospital-based surveillance demonstrated the emergence of atypical DS-1-like G1P[8] rotaviruses in 2013; similar to what has also been reported from some countries. There are, however, no data demonstrating how effective rotavirus vaccines are against them.

Aim: To examine whether the emergence of DS-1-like G1P[8] strains could be due to reduced protection afforded by the Wa-like G1P[8] HRV and also estimate its effectiveness (VE) against DS-1-like G1P[8] strains, and against concurrently circulating G2 strains with a DS-1-like genetic backbone.

Methods: Whole genome sequences (WGS) were generated using Illumina technology from G1 and G2 rotavirus strains that were randomly selected each month in children under 5 years who were hospitalised with diarrhoea in Blantyre, Malawi between January 2013 and December 2015. Logistic regression was used to calculate VE by comparing the odds of rotavirus vaccination among rotavirus EIA-positive cases and rotavirus test-negative controls.

Results: Of 216 rotavirus strains sequenced, 53% (114/216) had a Wa-like, 44% (88/216) had a DS-1-like and 3% (14/216) had mosaic genotype constellations. Among those with Wa-like constellation, 72% were G1, 25% were G12 and <1% were G2 strains. Of the DS-1-like strains, 69% were G2 and 31% were G1 rotaviruses. Of the 110 G1 strains analysed by WGS, 75% and 25% were Wa-like and DS-1-like, respectively. Atypical G1 rotaviruses with DS-1-like genotype constellation were detected for the first time in Malawi in 2013; their circulation peaked in 2014 and subsequently decreased in 2015 (<1%, *n*=1/72). Vaccine effectiveness among infants hospitalised with acute DS-1-like G1P[8] rotavirus gastroenteritis was 85.6% (95% CI: 34.4%, 96.8%), *P*=0.01, and was 62.8% (95% CI: -75.8%, 92.1%), *P*=0.212 against DS-1-like G2 rotaviruses.

Conclusions: High vaccine effectiveness against atypical G1P[8] strains, combined with their subsequent decline, suggests that their emergence was unrelated to vaccine introduction. These data support national recommendations for rotavirus vaccine use, particularly for low income countries with high burden of diarrhoeal disease.

Disclaimer

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