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Controlled human infection with Neisseria lactamica in pregnant women does not elicit mother-to-infant transmission

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Background

Neisseria lactamica carriage occurs in approximately 40% of young children, and correlates inversely with N. meningitidis carriage and invasive disease. Intranasal inoculation with N. lactamica is a safe and well-characterised human challenge model in healthy adults, although it has not previously been applied in pregnancy or childhood.

Aim/Methods

Healthy pregnant women were inoculated with 105 colony-forming units N. lactamica Y92-1009 at 36-38 weeks gestation. Maternal and infant oral, nasopharyngeal, breast milk and blood samples were obtained at birth, and at one, four and fifteen weeks post-partum. Colonisation was investigated using selective culture and whole genome sequencing (WGS). We hypothesised that inoculation would result in maternal colonisation and horizontal transmission to the infant.

Results

Twenty-one women were inoculated, and 71% (15) became colonised with N. lactamica Y92-1009. The inoculation strain was detected in only one infant at one time point (at birth). Conversely, Moraxella catarrhalis strain-sharing (confirmed by selective culture and WGS) was observed in 35% (6/17) of inoculated mother-infant pairs completing the study. Additionally, seven women already colonised with N. lactamica at screening were followed up but not inoculated, and N. lactamica strain sharing (non-Y92-1009) was observed in one mother-infant pair in this group. Of the thirty-one women screened, 41% (7/17) with a co-habiting child aged under five years were already colonised with N. lactamica, compared with 0% (0/14) without a co-habiting child (p=0.009), and oral sampling of co-habiting children at 15 weeks post-partum revealed N. lactamica colonisation (non-Y92-1009) in 42% (5/12). Antibiotic use was reported by 52% (11/21) inoculated and 71% (5/7) baseline-colonised women (indications unrelated to the study), which may have affected N. lactamica colonisation. Serum antibody and microbiome analyses are in progress.

Conclusions

Taken together, these results suggest that N. lactamica does not readily transmit from colonised mothers to infants, but that transmission may occur from co-habiting children to their mothers. Conversely, these data support M. catarrhalis transmission from mothers to infants, consistent with research highlighting M. catarrhalis as a common infant commensal. This is the first ever reported peripartum respiratory human challenge study, and this model could be adapted to study microbiome and immunological development using other respiratory commensals.