Title: Manipulating the baby biome: what are the issues?

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Abstract

Establishing a baby biome through the controversial practice of “vaginal seeding” has generated interest amongst the general public and healthcare providers alike. We discuss the potential risks of this practice and offer a harm minimisation approach to managing women requesting vaginal microbiome transfer after delivery by caesarean section.

Manipulating the baby biome: what are the issues?

The practice of establishing a baby biome through “vaginal seeding” has garnered both general media attention and the interest of obstetricians. As vaginal seeding gains popularity, it is imperative that healthcare providers are equipped with the knowledge to answer questions and appropriately assist women considering biome transfer following delivery by caesarean section.

The human microbiota, the microbial cells that colonise the human body, varies between individuals, anatomical location and age. It is also particularly impacted by broad spectrum antibiotic use. Differences in microbiota may be associated with altered susceptibility to both communicable and non-infectious diseases.¹⁻³ As such, manipulating the flora may change the likelihood of disease development. *Bifidobacterium* spp. and *Lactobacillus* spp. have long been viewed as beneficial bacteria that form part of the “normal flora” of the vagina which may prevent colonisation by potentially pathogenic organisms.³ However, the true vaginal microbiota is significantly more complex and diverse.

The development of an infant’s gut microbiota is influenced by multiple factors including mode of delivery, maternal prenatal antibiotic exposure, prematurity, breast feeding, introduction of solid food, geography and hospitalisation.^{1,2,4,5} In utero, the infant’s gut may be exposed to the microbial population of amniotic fluid and the placenta which is of low abundance and diversity.⁶ It then becomes rapidly colonised by facultative aerobes and strict anaerobes which originate from both maternal and environmental flora.⁷⁻⁹

Babies born vaginally are colonised with vaginal flora, which late in pregnancy consists predominantly of *Lactobacillus* spp. and mixed anaerobes.^{1,10} Those born by caesarean section are exposed to skin and environmental flora and as a result, have less *Bifidobacterium* and *Bacteroides* species and generally less biodiversity, particularly in the first month.⁷ The gut flora then increases in diversity, although there is significant inter-individual variability, especially in the first few years of life.^{1,5,11}

Alterations to early microbiota translates to changes that are seen up to 24 months after delivery, with less diversity found in children born by caesarean section.¹¹ As such it is speculated that the effect of caesarean delivery may be prolonged with disruption of the typical progression of microbiota, which may favour disease development in later life. Animal models suggest that this shift may drive immune mediated pathology. Although causality has not been demonstrated due to the logistical and ethical difficulties in performing randomised controlled trials or prospective cohort studies, the studies which have been carried out have indicated an association between asthma, type 1 diabetes and autoimmune conditions, such as coeliac and inflammatory bowel disease, in children born by caesarean section.¹¹⁻¹⁶ Dysbiosis of the infant gut can therefore impact on development, immunity and long-term physiological outcomes.⁷

It is speculated that manipulation of the caesarean section baby biome through vaginal seeding may result in a biome that is more reflective of the “natural state” and thereby influence disease development.^{1,2,7,17} It must be noted however that multiple factors, not only mode of delivery and resultant biome formation, can trigger the development of disease.¹⁴

Vaginal seeding is not a technically difficult procedure. In the published papers, a sterile gauze soaked in normal saline is inserted into the vagina 1 hour prior to caesarean section. It is removed pre-operatively and stored in a sterile container until the baby is born, after which the gauze swab is wiped onto the baby, starting at the mouth and face followed by the rest of the body.⁷ Given its simplicity, even without endorsement from the hospital, mothers could perform this surreptitiously without the knowledge of their healthcare provider. It is important for women to be made aware of potential harmful consequences of this practice and ways to minimise adverse events.

Arguments against vaginal seeding primarily highlight the harm from unnecessary exposure to potential pathogens. Mothers may be asymptomatic, but severe neonatal infections from exposure to vaginal pathogens and commensals could occur.

Organisms of particular relevance are group B Streptococcus (GBS), herpes simplex virus (HSV), Chlamydia trachomatis and Neisseria gonorrhoeae.^{2,4} Concern has also

been raised over vaginal seeding in the setting of chorioamnionitis and urinary tract infection as well as colonisation with multi-resistant bacteria. A recent article in the BMJ discourages staff from performing vaginal seeding, as the authors felt that the small risk of harm could not be justified without further evidence of benefit.⁴ If, however, these potential risks could be mitigated, the case supporting vaginal seeding is buoyed.

When GBS screening is performed in Australia it is generally at 35-37 weeks gestation in women who plan to have a vaginal delivery. Women found to be colonised with GBS or high risk women who have an unknown GBS status are ideally given intrapartum prophylaxis more than 4 hours prior to delivery, to reduce the incidence of early-onset neonatal GBS infection. Mothers planning an elective caesarean delivery may not be routinely screened for GBS.¹⁸ For women who are considering vaginal seeding, one approach would be to screen for GBS and if positive to recommend against vaginal seeding due to the 1/200 risk of neonatal GBS sepsis.¹⁸ Although unproven, another option would be for the mother to be admitted to receive an appropriate course of antibiotics 4 hours prior to collection of the vaginal biome and before undergoing caesarean section to reduce the risk of GBS transmission. This is similar to the approach used for GBS carrier women planning on a vaginal delivery.

Women with primary HSV infection late in the third trimester are advised to have a caesarean section as the risk of HSV transmission is up to 50%.^{18,19} Those who have recurrent HSV infections are not discouraged from vaginal delivery, as they have an overall transmission risk of <1%. Caesarean sections do not completely negate the risk of transmission and women are not screened for HSV when they plan to deliver vaginally.^{18,19} Vaginal seeding should be discouraged in women who have primary HSV late in pregnancy, whereas women who have a history of recurrent HSV could be counselled that the risk of transmission to baby may be higher than if they did not perform swabbing. Women with a history of recurrent genital herpes should be educated regarding the early signs of neonatal HSV infection and be advised to seek early medical advice.

The Australian recommendations from RANZCOG and the Department of Health Clinical Practice Guidelines support selective testing for those who may be considered at increased risk of chlamydia, such as young maternal age and recent change of partner.¹⁸ The NICE guidelines found insufficient evidence to support routine antenatal screening for chlamydia and there are currently no guidelines supporting routine antenatal screening for gonorrhoea,²⁰ largely due to the low prevalence in women in the general population. In practice, some clinician choose to perform routine antenatal screening for both, particularly in well delineated high risk populations. To reduce the risk of neonatal transmission of gonorrhoea and chlamydia through vaginal seeding, screening should be considered.

We agree with the BMJ authors that if a baby were born by caesarean section and had vaginal seeding performed, this should be notified to their healthcare provider who accordingly would need to consider treatment options if the baby became unwell. Clinicians should also ask about seeding status when assessing an unwell baby born via caesarean section.

At present there is no strong evidence explicitly demonstrating the benefit of vaginal seeding, but there are theoretical benefits which are being actively evaluated. Amongst clinicians opinions are divided as to whether an unproven practice should be medicalised, supported or discouraged. The vaginal microbiome transfer can be self-performed, is simple, inexpensive and potential harm can be reduced to the same or lesser level as that of vaginal delivery through screening or treatment. We would recommend that health facilities adopt an approach that endorses harm minimisation and provide a guideline to aid women in making an informed decision regarding altering their baby's biome.

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