Maternal Group B Streptococcus colonisation



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***Streptococcus agalactiae*, commonly known as Group B Streptococcus (GBS), is an important neonatal pathogen known to cause sepsis, meningitis and pneumonia. Australian pregnant women undergo screening during pregnancy in an effort to eradicate GBS before delivery where transmission to the neonate can occur. Preventative treatment includes intrapartum antibiotic prophylaxis and results in widespread treatment of the 10–40% of pregnant women colonised. GBS are separated into ten different capsular polysaccharide serotypes and previous studies have suggested associations between specific serotypes and disease. At present, however, minimal data exist on serotype distribution within Western Australian-pregnant women, information that may play an important role in future prophylactic treatment regimens. Our preliminary data, obtained from GBS isolated from vaginal swabs from 191 pregnant women, suggests that GBS serotype distributions in Western Australia are different to other parts of Australasia. In particular, compared to the eastern Australian states and New Zealand, in our cohort, serotype Ib prevalence was 7–17 times lower, II was 2–6 times greater and VI was 2–12 times greater. In addition, serotype IX represented 6.3% of all serotypes. Understanding which serotypes are present in our population will provide valuable data for future targeted treatment regimens such as vaccination and bacteriophage therapy.**

Group B Streptococcus during pregnancy

Neonates are among the most vulnerable forms of life, they enter this world with minimal immune defences and are faced with a vast array of opportunistic pathogens ready to colonise. One such organism is *Streptococcus agalactiae*, commonly known as Group B Streptococcus (GBS), which is responsible for morbidity and mortality in the immunocompromised, elderly and in particular, neonatal populations. GBS infection is a leading cause of sepsis and can also lead to meningitis, pneumonia, shock and even death[1,2]. It is understood that transmission of this organism can occur from a commensally colonised mother to her baby during birth, *in utero* (vertical) or alternatively through nosocomial transmission once born (horizontal)[3]. In an effort to prevent infant GBS infection, risk-based and culture-based screening of pregnant women followed by intrapartum antibiotic prophylaxis has been introduced in a number of countries globally[4]. In Australia, pregnant women are screened for presence of GBS several weeks before expected delivery to determine colonisation status. If a patient is found to carry GBS, antibiotics are administered prior to delivery in an effort to eradicate the organism before the neonate is exposed.

Serotypes

Global carriage rates among pregnant women are estimated at 10–40% which results in widespread antibiotic use in this population[4-6]. Due to contraindications of a number of drug classes during

pregnancy the antibiotics of choice include penicillin or if the woman is sensitised, cephazolin or clindamycin[4]. Penicillin resistance has rarely been described, however, clindamycin resistance is rising and has been reported recently in Australia[7]. Our current culture detection gives a presence/absence result and does not define characteristics of colonisation such as serotype. GBS are encapsulated and have a capsular polysaccharide (cps) locus that determines one of 10 serotypes (Ia, Ib, II–IX)[8–10]. Global distributions of these serotypes have shown variation in each region: for example, most countries have cps types Ia, Ib, II, III and V as the most common, although Japan has found prevalence of cps VIII, which globally is considered rare[11–13]. The capsule is considered an important virulence factor and some serotypes are associated with invasive disease more so than others[14]. For example, cps III has been observed in association with neonatal bloodstream infection, while cps V more so in cases of adult disease[15]. Understanding serotype distribution and its role in disease may improve the way we treat women during pregnancy.

GBS in Western Australia

Our research aims to determine which serotypes are prevalent amongst Western Australian pregnant women and explore alternative targeted treatment options. Our study is currently recruiting 1000 pregnant women at King Edward Memorial Hospital, Perth, Western Australia and collecting vaginal and rectal specimens at 14–22 and 34–38 weeks' gestation. The specimens are cultured and PCR tested for GBS presence and common serotypes Ia, Ib and III using our novel multiplex qPCR assay[16]. Other remaining serotypes are confirmed through methods described by Imperi *et al.*[17]. Initial retrospective studies of vaginal specimens from the UPCAN study[18] found interesting results compared to those previously reported in Australasia (Figure 1). The main differences in serotypes compared to other studies are seen for cps Ib, II, VI and IX in our WA cohort. We have identified a lower incidence of common serotype cps Ib and higher incidence of cps II, VI and IX. It must be noted, however, that a number of these previous studies had not tested for cps IX due to it only being proposed as a new cps type in 2009[10]. Comparison of cps IX to the Australia-wide study by Ko *et al.*[6] is appropriate, as testing for this new serotype was included, but no cases were detected.

Clinical impact and future directions

Monitoring of GBS strains within the pregnant community generates clinically useful information about this pathogen and can equip us for future targeted prevention and treatment strategies. For example, vaccination development targeting the capsule has now progressed with a number of candidate vaccines targeting multiple cps types such as Ia, Ib and III[24]. Knowledge of prevalent serotypes could impact our vaccination strategy as we discover differences in serotype distribution amongst different geographical populations. Another alternative targeted therapy that we are researching is bacteriophage therapy. The major principle behind this is that the specificity and lytic activity of these bacterial viruses could provide a targeted GBS treatment solution that would concurrently help to prevent emerging antibiotic resistance and microbiome dysbiosis, in addition to avoiding the unknown

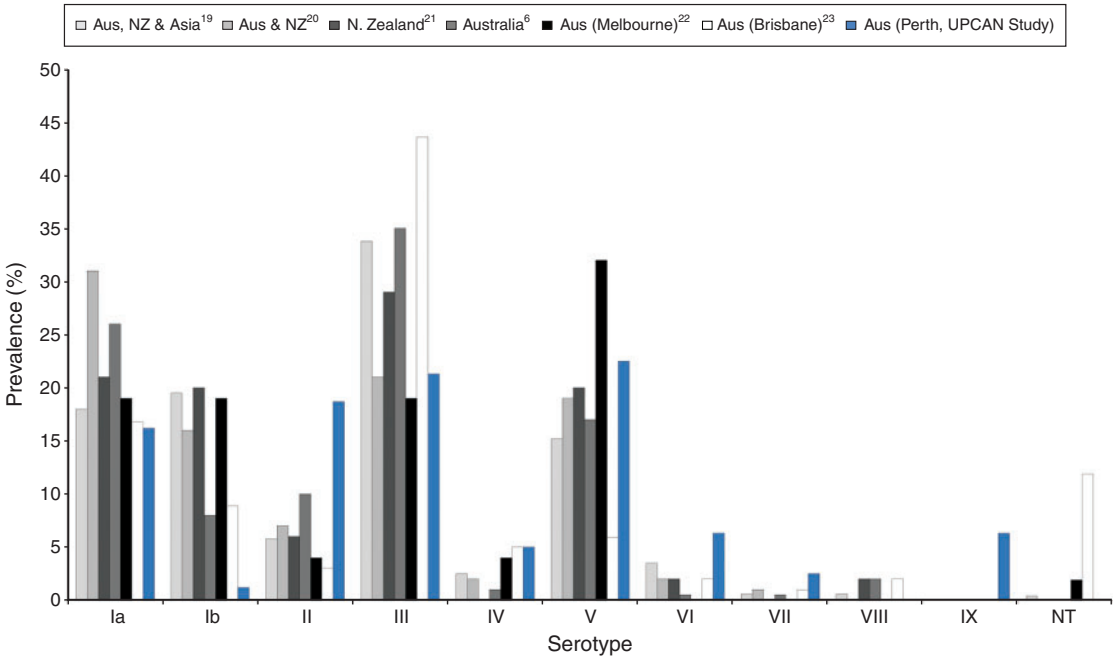

Figure 1. Prevalence of 10 *Streptococcus agalactiae* serotypes (Ia, Ib, II–IX) and non-typeable (NT) from previous studies across Australasia[6,19–23] compared to our preliminary Western Australian data.

impacts of antibiotic exposure on the newborn. We are currently isolating and testing novel bacteriophages for lytic activity against clinical GBS strains to assess future potential.

This research is all about defining our target in an effort to improve clinical detection and refining treatment strategies, to ensure we protect our vulnerable neonates.

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Biographies

Lucy Furfaro is a final year PhD candidate researching GBS dynamics in Western Australian pregnant women and a potential alternative treatment using bacteriophage therapy. She has developed a novel multiplex PCR assay to detect GBS and clinically relevant serotypes with the potential for diagnostic use.

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