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Review Article

Group B streptococcal carriage among pregnant women and its implications

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ABSTRACT

Group B streptococci are a group of gram positive cocci of Streptococcaceae family belonging to Lancefield group B, classified based on carbohydrate antigen. Streptococci are a group of gram positive cocci predominantly showing chain arrangement attributed to the type of cell division (linear). Among the various groups of streptococci group B Streptococci comprise normal micro biota of human genitourinary tract. Group B Streptococci are represented by *Streptococcus agalactiae* which are not only commensals but also recognized as a potential pathogen responsible for serious neonatal infections. Colonization in vagina prior to pregnancy may be considered as a risk factor for intra-partum and post-partum complications in pregnant women and neonates. Considering the fact that there are many serotypes of group B streptococci prevalent in different geographical regions and that there are no vaccine available, studies on epidemiology of colonization among risk groups and potential pathogenic nature of the colonizing bacteria assume significance. This paper enlivens the current knowledge of epidemiology of group B Streptococci.

Keywords: Group B Streptococci, Pregnant women, Neonatal infections caused by group B Streptococci, Colonization of group B Streptococci

INTRODUCTION

Streptococci are a group of gram positive cocci which are usually arranged in singles, pairs and chains. They are differentiated from other gram positive cocci (*Staphylococcus spp.*) based on their lack of ability to produce catalase enzyme. Most of the species of streptococci are fastidious and require blood/serum containing media for their growth except Enterococci/group D streptococci. Streptococci are classified based on the type of haemolysis they produce on sheep blood agar in to alpha-haemolytic (greenish discoloration surrounding the colonies indicating partial haemolysis), beta haemolytic (clear zone of no red blood cells surrounding the colonies indicating complete haemolysis) and gamma/non-haemolytic streptococci (no change on blood agar surrounding the colonies). Beta

haemolytic Streptococci are further classified based on their carbohydrate antigen in to various Lancefield groups (groups A to U except I and J).¹ Among the species of streptococci, the group A streptococci represented by *Streptococcus pyogenes* can be present as a normal micro biota of upper respiratory tract of healthy adults, which is a common causative agent of sore throat. Group B Streptococci are identified as *Streptococcus agalactiae* which are occasionally present colonized in the genitourinary tract of females and as a causative agent of puerperal fever and neonatal meningitis. Group C, E, F and G streptococci are associated either with colonization or infection in animals (*Streptococcus equi*, *Streptococcus equisimilis*) and are rarely are isolated from human infections. Another group of streptococci that are identified as group D streptococci which contain both enterococcal (*Enterococcus faecalis*, *Enterococcus*

faecium, *E durans* and *E avium*) and non-enterococcal (*Streptococcus equines*, *Streptococcus bovis* group containing *S. galloglyticus* spp. and *S. infantarius* spp.) streptococci are present as commensals in the gastrointestinal tract of human and animals. Group D streptococci are associated with many human infections including urinary tract infections, wound infections, bacteraemia, endocarditis, infections in individuals suffering from colonic and gastrointestinal cancers and other celiac diseases. Oral cavity of humans are colonized by a group of alpha haemolytic streptococci called as viridians Streptococci containing at least five species that include *Streptococcus mutans*, *S. oralis*, *S. milleri*, *S. mitis*, *S. salivarius*, *S. parasanguinis* and *S. sanguinis*. These streptococci are associated with infections after dental manipulations, dental caries and sub-acute bacterial endocarditis and bacteraemia in immunosuppressed individuals. *Streptococcus pneumoniae* are a group of alpha haemolytic Streptococci present as lanceolate shaped Diplococci possessing capsule.² They may be present as colonized in the lower respiratory tract in human and are responsible for causing lobar pneumonia in debilitated humans (children below 5 years and geriatric age groups).

PATHOGENIC POTENTIAL OF GROUP B STREPTOCOCCI

Group B streptococci also referred to as *Streptococcus agalactiae* has been identified as a causative agent of neonatal meningitis and other neonatal infections. In developing countries and financially poor third world nations, the practice of normal deliveries performed by unqualified health care providers could result in serious consequences to both mother and the foetus. Colonization of Group B streptococci during pregnancy and its transfer to the neonate while passing out through the birth canal causing both early on-set and late on-set group B streptococcal disease is leading to severe morbidity and mortality. Epidemiology of Group B streptococci assumes greater significance because such colonized pregnant women and the neonate may suffer from serious infections. Group B streptococci could cause bacteraemia and urinary tract infections (vaginitis, urethritis, cystitis and pyelonephritis) in the colonized pregnant women and neonates may suffer from sepsis, meningitis and lower respiratory tract infections. Identification of pregnant women who are asymptotically colonized by Group B streptococci in vagina could reduce the complications arising post-partum to both mother and child.²

GLOBAL EPIDEMIOLOGY OF GROUP B STREPTOCOCCI

Only fewer reports are available in literature regarding group B streptococci vaginal carriage. A cross-sectional study from Pakistan by Chaudhry BY et al., which included 200 pregnant women attending Gynaecology and obstetrics department of Benazir Bhutto hospital, Rawalpindi have collected lower vaginal swabs from the

pregnant women and ear swabs and swabs from the abdominal skin of neonates. This study has noted a carriage rate of 8.5% among pregnant women and the transmission rates in new-born to abdominal skin and ear canal was found to be 53% and 18% respectively.³ A recent review has observed that both pregnant women and non-pregnant women may suffer from a condition called as aerobic vaginitis, as a result of reduced normal flora (Lactobacilli) and increased aerobic bacterial microbes like the group B Streptococci, *Staphylococcus* spp, *Escherichia coli* and others.⁴ A study from Iran by Mohsen Haghshenas Mojaverii et al. which included 400 pregnant women (gravid one) in gestational age of 35-37 weeks have noted a carriage rate of 15.2% and that the neonates born to such mothers are colonized at 7.75% on their skin. The transmission rates from colonized mother to child were found to be almost 50%.⁵ A study carried out in pregnant women present at refugee camp along the Thai-Myanmar border by Claudia Turner et al. has observed that group B Streptococcal carriage rate was 12% (95% CI: 9.4-15.0). This study utilized both conventional culture methods (8%) as well as Polymerase Chain Reaction (PCR) (3.5%) for isolation of group B streptococci. The study has also noted that among the serotypes type II was the most frequent one isolated.⁶ A study performed among polish women by Brzywczy-Włoch M et al. which screened 1176 pregnant women, has noted a carriage rate of 30%. The same study has observed that serotype III (35%) was most predominant followed by serotype Ia (20%).⁷ A German study reported by Brimil N et al which collected vaginal and rectal swabs from pregnant women as well as non-pregnant women has found similar carriage rates (16%) and that serotypes III (28%) and II were predominant (21%).⁸ A very recent study and first of its kind from Argentina by Oviedo P et al. has observed a colonization rate of more than 9% among pregnant women and the serotype Ia was most common isolate.⁹ Study performed among Romanian women by Usein CR et al. have collected vaginal swabs from 100 subjects and noted that serotypes II (26%), III (26%) and Ia (19%) were more frequently isolated. The same study has also observed that the group B streptococci isolated were most sensitive to penicillin (100%) and ampicillin (100%), chloramphenicol (87%) and least sensitive to tetracycline (5%).¹⁰ A very recent report from Brazil by Dutra VG et al which screened pregnant, non-pregnant and healthy adults using both conventional phenotypic methods as well as PCR and Pulse-Field Gel Electrophoresis (PFGE) have noted that among the serotypes observed Ia (27.6%), II (19.1%), Ib (18.7%) and V (13.6%) were the most frequently isolated.¹¹

A study from Egypt Shabayek SA et al. which screened 150 pregnant women in their gestational age between 35 to 40 weeks noted a carriage rate of 25% and that the isolated group B streptococci showed 100% sensitivity to penicillin, ampicillin and vancomycin.¹² Another very recent report from Egypt by same authors has studied the antimicrobial susceptibility profile of 100 isolates of

colonizing group B streptococci and observed that the sensitivity profile remains almost the same and that tetracycline was ineffective with a resistance rate of 98%.¹³

CARRIAGE RATES OF GROUP B STREPTOCOCCI IN INDIA

An Indian report has noted that 98% neonates born to colonized women remain health without developing either early on-set or late on-set group B Streptococcal disease.¹³

Only few studies have been reported from India regarding the carriage rates of group B Streptococci among pregnant women.¹⁴ Among them two studies have been done more than two decades ago. A study by Dalal BS et al. noted a colonization rate at 9.8% and another study in the 1990's by Chaudhary U et al. observed a carriage rate of 16%.^{15,16} A study by A. A. Kulkarni et al. in 2001 which screened 347 pregnant women and their neonates attending during 1998 and 1999 reported a carriage rate of 2.5% among pregnant women and 1.2% colonization in neonates.¹⁷ Another study by V. Sharmila et al. which included 300 pregnant women and screened for group B streptococcal colonization by collecting rectal swabs and vaginal swabs have noted a carriage rate of 2.3%.¹⁸ A recent study from India reported by Kavitha P. Konikkara et al. from south India included 150 pregnant women in their third trimester and collected high vaginal swabs and screened for group B Streptococci employing conventional culture methods. This study revealed a colonization rate of 12%. The sensitivity profile of the isolated *Streptococcus agalactiae* was variable towards ampicillin (89%), gentamicin (79%), clindamycin (59%), erythromycin (58%) and showing 100% sensitivity to penicillin-G.¹⁹

RECOMMENDATIONS REGARDING SCREENING FOR GROUP B STREPTOCOCCAL COLONIZATION

Risk factors for group B Streptococcal infections include preterm labour (gestational age <36 weeks), prolonged rupture of membrane (more than 18 hours), intra-partum fever (temperature >38°C), previous history of complications arising due to group B Streptococcal colonization and infection. Several scientific associations including the American college of obstetricians and gynaecologists and the American academy of paediatrics also have recommended screening of pregnant women for group B Streptococcal colonization which was also supported by the Centre for Disease Control (CDC).²⁰ The revised 2010 Centre for Disease Control (CDC) guidelines recommended for prevention of perinatal group B Streptococcal infections include use of improved laboratory techniques for the identification of *Streptococcus agalactiae*, clarity among clinical microbiologists about the colony-count threshold required for reporting group B Streptococcal isolated in

the urine of pregnant women, updated algorithms for screening *Streptococcus agalactiae* and intra-partum antibiotic prophylaxis for women with pre-term labor or pre-term premature rupture of membranes that includes a change in the recommended dose of penicillin-G and updated chemoprophylaxis regimens for women with penicillin-G hypersensitivity and a revised algorithm for management of new-borns born to colonized women with respect to risk for early-onset group B Streptococcal disease. CDC has also noted that the colonization rates of group B Streptococci have remained the same since pat four decades and that the incidences of early-onset disease have significantly reduced.^{21,22}

CONCLUSION

From the available literature it is clearly evident that group B Streptococci are present as a normal micro biota of female genital tract in more than 10% women. Pregnant women when colonized with such bacteria may be predisposed to intra-partum and post-partum morbidity and mortality. The available studies also enlighten the fact that pregnant women carrying *Streptococcus agalactiae* in their genital tract may transmit the bacterium to the child during the normal deliveries resulting in postpartum and neonatal complications. Although in recent times the caesarean sections have increased over vaginal deliveries due to various reasons, most of the developing and third world countries still follow normal delivery procedures which increase the chances of complications arising from group B Streptococcal colonization/infection. With only limited number of studies available throughout the world regarding the colonization rates of group B Streptococci among pregnant women, the prevalent serotype, their virulence, potential predisposing factors for colonization and complications and the antimicrobial susceptibility profile, further research in future in this regard is warranted.

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