Prevalence of Group B Streptococcus Colonization in Pregnant Women in Jiangsu, East China

Rui Wang
Kingmed Diagnostics
Hongmei Qiu
Medical College of Dalian University
Ge Yanmei (gym8902@163.com)
Kingmed Diagnostics https://orcid.org/0000-0002-0152-7846
Fei Pan
Kingmed Diagnostics
Shuhui Bian
Kingmed Diagnostics

Research article

Keywords: Group B streptococcus, prevalence, colonization, antibiotic

Posted Date: November 1st, 2019

DOI: https://doi.org/10.21203/rs.2.16719/v1

Abstract

Background : Group B streptococcus (GBS) is the leading cause of early-onset neonatal sepsis. This study assessed the prevalence of GBS colonization among pregnant women in Jiangsu, East China.

Methods: A total of 16,184 pregnant women at 34 to 37 weeks , gestation aged 16–47 years were recruited from Nanjing Kingmed Diagnostics, including 9022 pregnant women who received GBS screening by PCR detection and 7162 by bacterial culture, antimicrobial susceptibility testing was performed on GBS positive samples.

Results: The overall GBS prevalence was 8.7% for pregnant women studied by PCR and 3.5% by culture. The 25-29 age group had the highest rate of GBS colonization in the pregnant women. The prevalence of resistance to erythromycin, clindamycin and levofloxacin was 77.5%, 68.3% and 52.2%, respectively.

Conclusions: This study revealed the prevalence characteristics of GBS in pregnant women and the difference of GBS colonization between culture and PCR in Jiangsu province.

Backgrounds

Group B streptococcus (GBS) is the leading cause of early-onset neonatal sepsis in many countries [1]. It is also a major causative pathogen of meningitis and has been associated with preterm labor, prematurely ruptured membranes, chorioamnionitis, and puerperal and fetal infections[2,3]. Screening of pregnant women for GBS colonization during the third trimester, coupled with targeted intrapartum antibiotic prophylaxis (IAP) of colonized women during labor, has reduced the incidence of invasive GBS disease in industrialized countries[4]. GBS detection and identification has become more commonplace, due to the availability of polymerase chain reaction technology[5]. However, the traditional method of culture of GBS is still the gold standard.

Penicillin, ampicillin and cefepime are the main drugs of choice to treat GBS infection. Vancomycin, macrolides (such as erythromycin, azithromycin, and clarithromycin), and lincosamides (clindamycin) may be used as the alternative drugs for patients allergic to penicillin or cephalosporins[6-9].

In the study, we investigated the GBS colonization rate in pregnant women in Jiangsu, China. At the same time, we compared the difference in the infection rate of GBS between the two methods of culture and PCR and calculated the sensitivity of GBS to different antibiotics .

Methods

Study population

Between June of 2017 and June of 2019，the pregnamt women at 34 to 37 weeks, gestation who resided in Jiangsu Province and received GBS screening at Nanjing KingMed Diagnostics were studied

participation. We performed an analysis of 16,184 women aged 16–47 years, including 9022 pregnant women who received GBS screening by PCR and 7162 by culture, antimicrobial susceptibility testing was performed on GBS positive samples.

Specimen collection

The pregnant women had not received antibiotic treatment for at least two weeks prior to recruitment into the sample collection[10]. A set of vagino-rectal swab samples consisting of two swabs were taken. Specimens were collected by a gynaecologist and taken as part as standard care, over the course of two years from 16,184 pregnant women.

PCR assays

GBS were detected using the Group B Streptococcus (GBS) nucleic acid detection kit (BioChain (Beijing) Science & Technology. Inc.). Briefly, DNA was extracted, then 100 ng (5μl) GBS DNA was used as template and added into 35 μl reaction mixture .

Microbiology (culture)

Cotton swab samples from pregnant women were inoculated into GBS Chromogenic Agar Plate (Autobio), then incubated at 37°C in ambient air for 24-48 h. The colonies on the solid media were presumptively identified as Group B Streptococcus if they forming light red to dark red colonies on CHROMagarStrepB.

Antimicrobial susceptibility test

The disk diffusion method was used to measure resistance to penicillin, ampicillin, cefepime, cefotaxime, ergomycin, clindamycin, chloramphenicol, linezolid, vancomycin and levofloxacin according to the Clinical and Laboratory Standards Institute (CLSI) standards and guidelines for Streptococcus pneumoniae ATCC49619 [11].

Statistical analysis

Statistical analyses were performed using SPSS version 19.0 (IBM, Armork, NY, USA). A proportion which summarized as a percentage and 95% confidence interval (95% CI) were calculated to estimate GBS prevalence rate. The chi-squared (x^2) was used to compare proportions of different age groups. A p-value of <0.05 was considered statistically significant.

Results

The prevalence of GBS infection A total of 16,184 pregnant women were enrolled in the study. 789 participants (8.7%, 95% CI: 8.2%-9.3%) out of 9022 women studied by PCR showed GBS colonization, while 249 (3.5%, 95% CI: 3.1%-3.9%) of 7162 women investigated by culture were colonized (Table1). Prevalence of GBS colonization among pregnant women of different age groups The analysis of the

prevalence of positive GBS results were presented by different age groups (≤24 years, 25-29 years, 30-34 years, 35-39 years and ≥40 years). Among the women by PCR, the highest rate of GBS colonization (9.4%, 95% CI: 8.5-10.4%) was the 25-29 age group and the lowest prevalence rate (7.5%, 95% CI: 6.3-8.6%) was the under 24 age group (P=0.011). In the women by culture , people aged over 40 years had the highest prevalence rate (7.1%, 95% CI: 2.0-12.3%) and the under 24 age group had the lowest prevalence rate (3.2%, 95% CI: 2.3-4.0%) (P=0.034). However, considering that the over 40 age group had a small sample size, if remove the group, the 25-29 age group owned the highest rate of GBS colonization (3.6%, 95% CI: 3.0-4.3%) in the women by culture (Table 2). From above analysis, it was obvious that the 25-29 age group had the highest rate of GBS colonization in the pregnant women. Antimicrobial susceptibility Antimicrobial susceptibility test for GBS colonized samples in the women by culture, all samples were susceptible to penicillin, linezolid and vancomycin. The prevalence of resistance to erythromycin, clindamycin and levofloxacin was 77.5%, 68.3% and 52.2%, respectively (Table 3).

Discussion

GBS infection can be transient or persistent during pregnancy, which inevitably leads to different results of GBS in the same pregnant woman at different times of pregnancy[1,12]. Therefore, we should choose the same stage of pregnant women when studying the infection rate of GBS. There are regional differences of GBS colonization in pregnant women. For example, the reported prevalence of GBS for Africa is 22.4%, Southeast Asia is 11.1% and Taiwan is 23.7%[13-14]. Unfortunately, large-scale multicenter epidemiological studies on maternal GBS colonization in mainland China are still rare[15].

So far, there have been many regional studies on the rate of GBS colonization in China. It was reported that the prevalence of GBS for Beijing was 7.1% and Qingdao in Shandong Province was 10.61% in Northern China[16-17]; Shanghai was 3.7% and Nanjing was 4.16% in Eastern China[18-19]; Chongqing was 7.05% and Chengdu in Sichuan Province was 5.02% in Southern China[20-21]. The infection rates of GBS are vary widely in different parts of China, and the prevalence of GBS in northern region is significantly higher than the eastern region. The main reason for this difference may be related to local economic levels and environmental factors. Another important factor is the neglect of detection method of GBS.

In our study, the rate of GBS colonization obtained by culture only (3.5%) was much lower than the rate obtained by PCR (8.7%) in Jiangsu, China. This is mainly because PCR is a rapid method which more sensitive and specific than culture. It may be due to the presence of nonviable GBS or low bacterial load in vaginal swabs, which cannot be detected by culture, but their DNA could be present for PCR amplification[22-23]. Some pregnant women colonized by GBS might be missed only using a culture method.

Compared with other age groups, it was obvious that the 25-29 age group had the highest rate of GBS colonization in both groups of all the pregnant women. It may be related with the sexually active life, history of induced abortion and higher estrogen levels during pregnancy in this age group. These factors

can cause microenvironmental changes in the genital tract bacteria. Therefore, for pregnant women of this age, we should do a better screening of GBS.

The Centers for Disease Control (CDC) guidelines regarding that IAP agents and dosing should be administered according to the test results of GBS among pregnant women. Penicillin remains the agent of choice for IAP, with ampicillin as an acceptable alternative. Antimicrobial susceptibility testing should be ordered for antenatal GBS cultures performed on penicillin-allergic women at high risk for anaphylaxis. Then, the right antibiotic could be choosed according to the results of antimicrobial susceptibility testing.

Previous studies on GBS bacteremia in adults during 2002 to 2010 in USA had shown that erythromycin and clindamycin resistance occurred in 43.6% and 39.7% of cases, respectively[24]. And the prevalence of resistance to erythromycin and clindamycin from Taiwan for the period 2006– 2008 was 58.3% and 57.9%, respectively [25]. In our study, the prevalence of resistance to erythromycin and clindamycin was 77.5% and 68.3%, respectively. It was higher than the prior studies. The goal of our research is pregnant women, which is a special group of people. It may be the main cause of this difference.

Conclusions

In the present study, we presented the data on the prevalence of GBS colonization in pregnant women in Jiangsu, East China. At the same time, we compared the difference of GBS colonization between culture and PCR. Such data could guide interventions to control prevalence of GBS. 25-29 years old pregnant women had highest GBS prevalence and should be paid more attention. IAP agents and dosing should be administered according to the test results of GBS among pregnant women.

Declarations

Abbreviation

GBS: Group B Streptococcus ; IAP: intrapartum antibiotic prophylaxis;

CI: Confidence interval

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Nanjing KingMed Diagnostics. The Ethics Committee of Nanjing KingMed Diagnostics concluded that no informed consent was required because the data are anonymized appropriately.

Consent to publish

Not applicable.

Availability of data and materials

The data and materials used during the study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

No funding was obtained for this study.

Authors' Contributions

RW and HMQ carried out the sample collections, laboratory detection and drafted the manuscript. YMG drafted and revised the manuscript. FP and SHB participated in the design of the study and the statistical analysis. All authors read and approved the final manuscript.

Acknowledgments

We would like to thank Kingmed Diagnostics for providing the data used in this paper.

References

1. Verani JR, McGee L, Schrag SJ; Division of Bacterial Diseases, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention (CDC). Prevention of perinatal group B streptococcal disease—revised guidelines from CDC, 2010. MMWR Recomm Rep. 2010; 59(RR-10):1-36.
2. Edwards MS, Baker CJ. Streptococcus agalactiae (group B streptococcus). In: Bennett JE, Dolin R, Blaser MJ, edi-tors. Mandell, Douglas, and Bennett's principles and practice of infectious diseases. 8th ed. Philadelphia (PA): Elsevier/Saunders; 2015. p.2340-8.
3. Infectious diseases. In: Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, et al., editors. Williams obstetrics. 24th ed. New York (NY): McGraw-Hill Education/Medical; 2014. p.1249-51.
4. Schrag SJ, Schuchat A (2004) Easing the burden: characterizing the disease burden of neonatal group B streptococcal disease to motivate prevention. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America 38: 1209–1211.
5. Huang J, Lin X-Z, Zhu Y, Chen C, Epidemiology of group B streptococcal infection in pregnant women and diseased infants in mainland China. *Pediatrics and Neonatology*, https://doi.org/10.1016/j.pedneo.2019.07.001.

6. de Azavedo JC, McGavin M, Duncan C, Low DE, Mcgeep A. Prevalence and mechanisms of macrolide resistance in invasive and noninvasive group B Streptococcus isolates from Ontario, Canada. *Antimicrob Agents Chemother* 2001;45:3504-8.
7. von Both U, Buerckstuemmer A, Fluegge K, Berner R. Heterogeneity of genotype-phenotype correlation among macrolide-resistant Streptococcus agalactiae isolates. *Antimicrob Agents Chemother* 2005;49:3080-2.
8. Chohan L, Hollier LM, Bishop K, Kilpatrick CC. Patterns of antibiotic resistance among group B Streptococcus isolates: 2001-2004. *Infect Dis Obstet Gynecol* 2006;2006:57492.
9. Heelan JS, Hasenbein ME, McAdam AJ. Resistance of group B Streptococcus to selected antibiotics, including erythromycin and clindamycin. *J Clin Microbiol* 2004;42:1263-4.
10. Chukwu MO, Mavenyengwa RT, Monyama CM, Bolukaoto JY, Lebelo SL, Maloba MRB, Nchabeleng M, Moyo SR. Antigenic distribution of Streptococcus agalactiae isolates from pregnant women at Garankuwa hospital – South Africa. *GERMS* 2015;5(4):125-133. doi: 10.11599/germs.2015.1080
11. Performance standards for antimicrobial susceptibility tests; approved standard, 12th ed. M100-S20-U. Clinical and Laboratory Standards Institute. Wayne, Pennsylvania, USA, 2010.
12. Di RG, Melin P, Berardi A, Blennow M, Carbonellestrany X, Donzelli GP, et al.

Intrapartum GBS screening and antibiotic prophylaxis: a European consensus conference.

Journal of Maternal-Fetal Medicine 2014;28:766-82.

13. Kwatra G, Cunnington MC, Merrall E, Adrian PV, Ip M, Klugman KP, et al. Prevalence of maternal colonisation with group B streptococcus: a systematic review and meta-analysis. *Lancet Infect Dis* 2016;16:1076-84.
14. Hsu JF, Chen CL, Lee CC, Lien R, Chu SM, Fu RH, et al. Characterization of group B Streptococcus colonization in full-term and lete-preterm neonates in Taiwan. *Pediatr Neonat*ol 2018;pii: S1875-9572(18)30059-7.
15. Huang J, Lin X-Z, Zhu Y, Chen C, Epidemiology of group B streptococcal

infection in pregnant women and diseased infants in mainland China, Pediatrics and Neonatology, https://doi.org/10.1016/j.pedneo.2019.07.001.

16. Lu B, Li D, Cui Y, Sui W, Huang L, Lu X. Epidemiology of Group B streptococcus isolated from pregnant women in Beijing, China. *Clinical Microbiology & Infection* 2014;20:370-3.
17. Wang X. The relation between maternal colonization of group B streptococcus in late pregnancy and the pregnancy outcome. *Journal of Baotou Medical College* 2015;31:34-5.
18. Chen HH, Fan JX, Lu TY, Xu TY. Effect of group B streptococcus infection on pregnant women and their infants. *Shanghai Medical Journal* 2009;32:128-30.
19. Ji XQ, Lu GS, Hu P, Cheng J, Liu Y, Lin Y. Colonization of group B Streptococcus in late pregnancy by fluorescence quantitation PCR in Nanjing area. *Laboratory Medicine* 2014;29:628-30.

20. He JW, Zhang Y, Chen M, Yuan Y, Fan C, Li QQ, et al. Effect of group B streptococcus infection on pregnant women of different reproductive ages in Chongqing. *International Journal of Laboratory Medicine* 2016;37:2784-6.
21. Jidi AY, Ma J, Tong W, Xiao XL. Risk factors for group B streptococcus colonization among pregnant women and effectiveness of intrapartum antibiotic prophylaxis on maternal and newborn outcomes. *Journal of Clinical Medicine in Practice* 2017;21:194-6.
22. AtkinsKL, Atkinson RM, Shanks A, Parvinn CA, Dunne WM, Gross G. Evaluation of Polymerase Chain Reaction for Group B Streptococcus Detection Using an Improved Culture Method. Obstetrics & Gynecology. 2006; 108(3, Part 1):488-491.
23. Ostroff RM, Steaffens JW. Effect of specimen storage, antibiotics, and feminine hygiene products on the detection of Group B Streptococcus by culture and the STREP B OIA test. Diagnostic Microbiology and Infectious Disease. 1995; 22(3):253-259.
24. Kaseman JA, Myers NM, Miracle JE, Myers JP. Group B streptococcal bacteremia in adults in the 21st century: review of 132 episodes over a 10-year period in a large community teaching hospital. Infect Dis Clin Pract 2013;21:105–10.
25. Wang YH, Su LH, Hou JN, Yang TH, Lin TY, Chu C, et al. Group B. streptococcal disease in nonpregnant patients: emergence of highly resistant strains of serotype Ib in Taiwan in 2006 to 2008. J Clin Microbiol 2010;48:2571–4.

Tables

Due to technical limitations, tables are only available as a download in the supplemental files section

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Table2.xls
- Table1.xls
- Table3.xls