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Perinatal transmission of Group B Streptococcal infection

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Group B Streptococcus (GBS) is a leading cause of invasive bacterial infection in newborns and also affects pregnant women. The objective of this study was to determine the vertical transmission of GBS infection from mothers to fetus. It was hospital-based cross-sectional descriptive study. One hundred and fifty pairs of pregnant women and their neonates were studied in Mandalay 300 bedded hospital between May, 2006 and April, 2007. Swabs from both vagina and rectum from mothers and ear, nose and umbilicus from neonates were collected and cultured on selective media. Risk factors were investigated by chart review and hygienic status of mothers was assessed by investigators. The overall maternal GBS colonization rate was 16% and perinatal transmission rate was 75% (n =18/24). Significant vertical transmission was observed from colonized mothers to their infants (OR = 91.5) ($p < 0.001$). The association between maternal GBS colonization and maternal conditions such as prolong labour, fever and premature rupture of membrane (PROM) was observed. Erythromycin and tetracycline were the most sensitive drugs on GBS. Ampicillin was effective in vaginal site colonization only. Penicillin was effective in ear colonization of the neonates only. This finding would be helpful to health-care providers in management of GBS infection among mothers and infants.

INTRODUCTION

Group B streptococcus (GBS), is the most common cause of life-threatening infections in newborns, especially sepsis and meningitis. GBS is a frequent cause of pneumonia and is more common than other, better known, newborn problems such as rubella, congenital syphilis, and spina-bifida. Aggressive intravenous antibiotic therapy successfully treats most babies who develop a GBS infection, but even with the best medical care 10-20% of these babies die and a few suffer long-term problems, most usually those who developed GBS meningitis. The prevalence of GBS colonization in various populations has ranged from less than 5% to more than 40%. One of the negligible signs for GBS infection is lack of examination of maternal GBS colonization, which are commensals for mothers and colonized women have no symptoms of disease. Approximately 8000 babies in the United States get GBS disease each year and 5-15 % of these babies die. GBS is a common type of the streptococcus bacterium. Approximately a quarter of childbearing age women carry it in their vagina. These women have potential for transmitting this organism to their newborn infants vertically or rarely, by hematogenous dissemination. The prevalence of GBS in pregnant women varies from place to place as reported by several workers the world over. Rates of

GBS colonization remain unpredictable and vary geographically, while rates of GBS disease are less often reported. GBS remains a leading cause of sepsis and pneumonia in the newborns despite the implementation of universal prenatal screening and intrapartum antibiotic prophylaxis in pregnant women [1].The most important problem in the prevention programme is the identification of the cases to treat, since it is not possible to give antibiotics to all women. Infection because of GBS is acquired through fatal aspiration of infected amniotic fluid or during passage through the vaginal canal [2]. More epidemiological studies and pathogen transmission, characterization and formulation of clinical management are urgently needed in both mothers and their neonates.

Currently, neonates born to women with unknown GBS status at delivery are unclear. So this study was done to provide the baseline data on GBS occurrence, transmission and their risk factors between mother and fetus.

MATERIALS AND METHODS

All the 150 pairs of enrolled neonates and their mothers underwent collection of specimens from surface sites for culture and sensitivity patterns from May, 2006 to April, 2007. All the specimens were collected by the investigators. Maternal personal hygienic status was identified by investigators. Good personal hygiene of mothers defined as they had neat and tidy hair condition, healthy look skin and short and clean nails. Poor personal hygienic conditions were in contrast to above criteria. Maternal complication status was stated in this study that the mothers had at least one or more of the following conditions such as maternal fever, prolong labour and premature rupture of membrane before delivery in the hospital.

Two vaginal and two rectal swabs were collected from each mother before no antiseptic application of the perineum or vulva. A total of three samples were collected from each newborn infant immediately after birth viz. external ear, nasal and umbilical swabs. These samples were immediately immersed in Todd-Hewitt broth (with colistin 10mcg/ml and nalidixic acid 15 mcg/ml) and sent to the Microbiology Department for staining and culture and sensitivity. These special broth media were incubated overnight at 35 to 37ºC for 18-24 hours. And then they were sub-cultured onto Granada medium and incubated again at 35 to 37ºC for 18-24 hours. Gram stains were also applied on these swabs and colonial growth from culture. The isolates were tested for antibiotic sensitivity by disc diffusion method of Kirby-Bauer by employing drugs on 5% sheep blood agar.

RESULTS

Socio-demography of study population

In our study, the number of births contributed by 20-29 years and 30-39 years age group were 67/150 (44.7%) and 63/150 (42%), respectively. Among these populations, most of the mothers were educated up to high school level (28.67%), followed by primary school level (28%), middle school (14%), illiterates (20%) and highly educated (9.33%). Most of the mothers were dependants (69.33%) and 19.33% of mothers could work on their own occupational status. Government staff and private workers were 6.0% and 5.33 %, respectively. Good personal hygienic status and poor personal hygienic status were 86.7% vs. 13.3%. In our study 2% of mothers had feverish condition during the study period. The temperature was >38° C. But almost all the mothers in this study were in state of well-being. In this study period, only 4 of 150 (2.7%) mothers present prolong labour. But all the rest of the mothers in our study came to the hospital with intact membrane. Only 6% (9/150) of pregnant women presented with premature rupture of membrane.

Maternal GBS colonization status was 16% in this tested population. In this study, neonatal GBS colonization rate was 14.7% (22 out of 150) and 85.3% of the neonates have no colonial growth. Overall nasal colonization rate in this study was 12% (18 out of 150); ear colonization rate and umbilical colonization rate were 10% and 6.67%, respectively. Both ear, nasal and umbilical regions were commonly found in these studied area (36.6%), second most common site was nasal region (22.7%) and the second last was ear and nasal region (18.1%). Umbilical region was the lowest colonization site (4.5 %).

In this study, erythromycin and tetracycline were the most sensitive drugs of this study population. Their sensitivity rates were more than 70% except to rectal site for erythromycin and nasal site for tetracycline. In vaginal site, ampicillin was effective in treatment for this organism only and penicillin could also be used in treatment of GBS colonization of ear site.

Association between GBS infection of mothers and neonates

Mothers with GBS colonization status during labour were 91.5 times more likely to infect newborns with streptococci (OR 91.5: 95% CI 20.05-476.81, p<0.001). Perinatal transmission rate was 75% (18 out of 24). Twenty-five percent (6 out of 24) of mothers could not give GBS transmission to their newborn infants in this study. But 18.1% (n=4/22) of newborns could not get vertical transmission of GBS from their mothers even though their mothers colonized with GBS. Maternal age, educational status and personal hygienic condition of mothers and vertical transmission are shown in Table 1, 2 & 3. Maternal complications (such as PROM and fever >100.4 ºF) were 2 times more likely to get infected newborn with streptococcal infection (OR: 2.09 95% CI 0.4-9.7, P=0.2479). Data demonstrating the relationship between intrapartum colonization of vagina and infant GBS infection were quite compelling (OR: 20.05 95% CI 1.68-537.7, p=0.0100).

The risk factors

Table 1. Age of mothers and neonatal GBS colonization status

Age	Neonatal GBS		Total
	Positive	Negative	
> or = 35 year	6	31	37
< 35 year	16	97	113
Total	22	128	150

(OR: 1.17: 95% CI: 0.37-3.6, p= 0.4713)

Table 2. Association between maternal education and neonatal GBS colonization

Education	Neonatal GBS		Total
	Positive	Negative	
Middle school and above	18	102	120
Primary school and Illiterate	4	26	30
Total	22	128	150

(OR: 1.14: 95% CI: 0.32-4.45: p= 0.5395)

Table 3. Personal hygienic condition and neonatal GBS colonization

Personal hygiene	Neonatal GBS		Total
	Positive	Negative	
Positive	5	15	20
Negative	17	113	130
Total	22	128	150

(OR: 2.21: 95% CI: 0.6-7.78: p=0.1438)

DISCUSSION

Group B *Streptococcus* (GBS) is an important cause of infection in pregnant women and their newborns; however, there had been a few studies in Myanmar. The association between the presence of the organism in the birth canal and invasive neonatal disease was recognized soon after the emergence of GBS as a major cause of neonatal infections, and hence the epidemiology of maternal colonization has been investigated extensively. This study revealed that the overall maternal GBS prevalence rate is 16% which is within the range of 5%-25% as documented in different parts of the world. But the occurrence rate of colonization in Mandalay is relatively high when comparing to reports from Yangon,

Myanmar (7.1%) [3]. According to these studies, GBS colonization rates remain variable according to geography. One study reported that colonization rates in the pregnant women ranged from 2% to 35% [4].

GBS recovery percentage from vaginal site and rectal site was 25% by culture assays in this study. Twelve out of twenty-four (50%) of women colonized in both rectal and vaginal region. Schuchat A & Wenger JD [5] stated that these bacteria asymptoatically colonize the vaginal or rectal areas of 10 to 30% of pregnant women and 40% to 70% in neonates born to colonized mothers. The prevalence of GBS colonization by culture in another study was 17% which is concordant with the reported rates of materal GBS carriage and vertical transmission [6]. The other six published studies from Latin America provide evidence of geographical variation in maternal GBS coloniation. These women with GBS colonization are considered candidates for intrapartum anti-biotic prophylaxis to prevent further trans-mission to neonates [7].

Between 30 and 70% of infants born to mothers with GBS colonization also become colonized at rectal, umbilical or oral sites [8].The most three common sites for GBS colonization in infants are ear, nasal and umbilical region in our study. But overall incidence of each sites of neonates are nasal area (12%), ear site (10%) and umbilical area is only 6.67 %.

In our study, newborn infants were definitely to be infected with GBS while their mothers had GBS colonization (OR: 91.5; 95% CI: 20.05-476.81, P< 0.001). Some of them would escape from vertical transmission even though the chance of transmission was high. One in 4 of colonied mothers could not give perinatal transision but 1 in 5 neonates could get GBS colonization even their mothers did not colonize with Group B *Streptococcus*. Vaginal colonization with GBS is essenially a prerequisite for both early colonization of newborn infant and early onset GBS [9, 10]. Failure of transmission from GBS colonized mothers to fetus may depend on density of maternal colonization. Many comparative studies showed that infants whose mothers have heavy genitourinary GBS colonization are more likely to become colonized [11] and the risk for GBS infection is much greater in heavily colonized neonates [12]. Failure to culture GBS even with ideal sampling and culture techniques may also be caused by maternal factors. The use of oral antibiotics or a variety of feminine hygiene products (including douches, vaginal candidiasis medication, and inert lubricants) before specimen collection may inhibit GBS growth in culture and contribute to false-negative results [13].

Our study also revealed that all the GBS isolated from both mothers and fetus are mostly sensitive to erythromycin and tetracycline assuming that sensitivity percenttages over 70% act as a sensitive drug for usage and the rest of the tested drugs such as penicillin, ampicillin, gentamycin and kanamycin have less sensitivity rate because their sensitivity percentages are less than 70%. Karen MP *et al.* [14] also reported that 20% were resistant to erythromycin and clindamycin. But in the report of Simoes J *et al.* [15], 17% of isolates were resistant to ampicillin and 15% showed penicillin resistance. Widespread use of antimicrobials is known to increase the risk for emergence of antimicrobial-resistant organisms and so surveillance is indicated to determine the potential for these phenomena.

The perinatal transmission rates also showed association between carriage of GBS among neonates and personal hygienic status of mothers and their education status. In this study, unhygienic condition of mothers can give 2 times likely to get GBS colonization in neonates (OR: 2.21; 95% CI: 0.71-6.88: P=0.1438). Ethnicity, maternal age and parity, marital status, education, smoking and frequent intercourse with multiple partners also may influence the prevalence of colonization [16]. Prolong labour was presented only in 4 of 150 GBS

infected infants and it was significantly associated with neonatal GBS colonization (OR: 20.05; 95% CI: 1.68-537.75, p=.2479). Prolong rupture of the membranes for >18 to >20 hours before delivery substantially increase the risk of neonatal GBS disease [17, 18]. Intrapartum temperature of >38°C is associated with vertical transmission of neonates in this study. One study stated that intrapartum fever of >38°C is associated with an increased risk of neonatal GBS infection [19]. This study was similar to the report of Cimolai and Roscoe [20] where GBS bacteraemia in infants born to mothers with a temperature of >37.5°C. All the GBS positive infants were asymptomatic in this study. The high incidence of GBS neonatal transmission in our survey may be related to the high maternal colonization rate with GBS in this area.

In conclusion, mothers with GBS bacteriuria during pregnancy can give perinatal transmission to their infants. Until effective GBS vaccines are available for clinical use, rapid and accurate diagnostic screening of women when they present for delivery may be the most effective approach to additional prevention of neonatal GBS disease in the current era. For now, culture of specimens from the rectum and lower vagina remain the gold standard for detecting GBS colonization in pregnant women [21]. The antibiotic selected for intrapartum chemoprophylaxis should be guided by the organism's antibiotic sensitivity pattern. Group B streptococcus is the most common cause of life-threatening infections in newborns especially umbilical sepsis, meningitis, pneumonia which can be occurred acutely and it can cause long-term complication such as vision or hearing disability.

Proper treatment with effective antibiotic can cure the disease. In our study, we recommend that erythromycin and tetracycline are the best choice for treatment and so outcome of study will provide the prevention and control of GBS diseases in Upper Myanmar.

Recommendations

1. Maternal health knowledge for personal hygiene and education should be scaled up to prevent transmission of infection to the infants.
2. Measures to reduce prolong labour should be encouraged to lessen perinatal GBS transmission.
3. Erythromycin should be provided as appropriate antibiotic prophylaxis for pregnant women having prolong labour.

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