

A study on association of early onset neonatal septicemia and maternal vaginal micro flora at a tertiary care center in Bihar

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Abstract

Introduction: Neonatal sepsis is the single most important cause of neonatal morbidity and mortality in the community, accounting for around 30- 50%. With this background, this study was planned to study the incidence of early neonatal septicemia and its correlation with the pattern of maternal vaginal flora in labor by the Department of pediatric medicine and Microbiology of Jawahar Lal Nehru Medical College & Hospital, Bihar, India. **Methodology:** A prospective cross-sectional study conducted from October 2020 to September 2021 by the Department of pediatric medicine and Microbiology of Jawahar Lal Nehru Medical College & Hospital, Bihar after approval from the ethical committee of the Institute. All consecutive antenatal women attending the outpatient or emergency department and getting admitted in the labour room were screened to be included in the study. Two high vaginal swabs (HVSs) were taken from the posterior fornix by a sterile cotton-tipped swab carefully not touching the anal area. The HVSs were transported to the microbiology lab immediately for processing. **Results:** Out of 150 women, 92 women (61.2%) showed vaginal colonization. Vaginal colonization was predominantly by gram-positive organisms in followed by a mixture of organisms and gram-negative organisms. The majority of women yielded coagulase-negative Staphylococcus aureus [CONS] followed by Escherichia coli in, methicillin-resistant S. aureus (MRSA) and methicillin-sensitive S. aureus (MSSA). **Conclusion:** Neonatal sepsis is one of the major causes of mortality and morbidity in neonates. Early onset neonatal sepsis (EONS) is a severe condition with high mortality rate. EONS commonly caused by maternal microorganism before or during the delivery process.

Key Words: Early Onset Neonatal Septicemia and Maternal Vaginal Microflora

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Introduction

The new-born period is one of the phases of increased vulnerability to infections and this threat begins right from the intrauterine period and passage through the maternal birth canal. Neonatal sepsis is the single most important cause of neonatal morbidity and mortality in the community, accounting for around 30- 50%. As many as 2% of fetuses are infected in utero, and up to 10% of infants have infections in the 1st month of life[1].

The incidence of sepsis in developing countries is higher (1.8-18/1000) than the incidence in developed countries (1-5/1000). WHO reports that 5 million babies do not survive until 28 days age per year and 98% of mortality are from developing countries. Neonatal deaths in developing countries were caused by infections (42%), asphyxia and birth trauma (29%), preterm babies and low birth weight (10%), congenital abnormalities (14%) and other causes (4%). Although the infection can be caused by viruses, fungi, and parasites, bacterial infection is the leading cause in neonatal sepsis[2]. The exposure that occurs during pregnancy or during childbirth is classified into early onset sepsis (early onset) and the exposure that occurs after birth is classified into slow-onset sepsis (late onset)[3].

Early onset sepsis is attributed to abnormal bacterial colonization of the maternal urogenital tract which leads to either an ascending but silent amniotic fluid infection or symptomatic chorioamnionitis[4].

Abnormal bacterial colonization of the rectum and anus during pregnancy may create an abnormal vaginal and cervical microbial environment.

Studies in the West have revealed Group B Streptococcus (GBS) causing infection among 1-2/1000 live births with mortality rates up to 20% in affected neonates due to preterm labour, sepsis, respiratory distress and meningitis or sometimes benign asymptomatic colonization[5].

In developing countries where the incidence of neonatal sepsis is high and is the leading cause of mortality in the new-born, the role of GBS is not conclusively proved and many other organisms have been suspected to be instrumental[6].

Identification of the abnormal colonization of the genital tract by a culture-based approach has been recommended by the CDC 2000. This will definitely aid in the early recognition of mothers who need to be effectively treated which in turn will prevent new-born infections. Furthermore, a baseline knowledge of empirical antibiotic therapy in clinically suspected sepsis of early onset can be standardized and established in our situation. In the long run reduction in neonatal mortality and morbidity can be achieved[7].

With this background, this study was planned to study the incidence of early neonatal septicemia and its correlation with the pattern of maternal vaginal flora in labor by the Department of pediatric medicine and Microbiology of Jawahar Lal Nehru Medical College & Hospital, Bihar, India.

Methodology

A prospective cross-sectional study conducted from October 2020 to September 2021 by the Department of pediatric medicine and Microbiology of Jawahar Lal Nehru Medical College & Hospital, Bihar after approval from the ethical committee of the Institute.

All consecutive antenatal women attending the outpatient or emergency department and getting admitted in the labour room were screened to be included in the study. We included low-risk pregnant women with a period of gestation of >28 weeks and in active labor (≥4 cm) with the intact membrane. Women with a history of any foul-

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smelling vaginal discharge, fever within seven days, antibiotics intake within seven days of admission, infected with HIV and active perineal infection, who had undergone five or more vaginal examinations during labor, undergoing cesarean section (lower segment cesarean section [LSCS]), or having any clinical features suggestive of chorioamnionitis were excluded from the study. Women who gave birth to the neonate with major congenital malformations non-compatible with life and Apgar score <3 at five minutes were also excluded from the study. A total of 500 women were screened during the study period; and finally 150 were enrolled for the study.

Labor details for the first, second, and third stages of labor were recorded in a predesigned Performa. All of the mothers were observed for the first 72 hours in the hospital for clinical signs and symptoms of sepsis and those with clinical signs were investigated further. They were followed up for two weeks afterward for clinical signs and symptoms of puerperal sepsis. Women were counseled regarding symptoms, for which they might require readmissions such as fever with purulent foul-smelling lochia, pain in the lower abdomen, episiotomy site infection/wound gape, abdominal distention, and other symptoms suggestive of puerperal sepsis.

For collecting samples, the woman was laid in a dorsal position for speculum examination. In one sampling, after asepsis of the perineal area, a clean Cusco's speculum was inserted into the vagina and two high vaginal swabs (HVSs) were taken from the posterior fornix by a sterile cotton-tipped swab carefully not touching the anal area. The HVSs were transported to the microbiology lab immediately for processing.

The data was collected in a Microsoft suite and analyzed using SPSS version 24.0 (IBM Corp., Armonk, NY). A p-value of <0.05 was taken as statistically significant.

Results

A total of 150 patients were included in the study. The mean age of the patients was 26.5 years with SD of 2.5 years. Socio-economic status of the women were enquired about using the modified Kuppuswamy scale. Majority of the women belonged to the upper lower class and another one-third belonged to lower middle class. Pre-pregnancy weights were noted and body Mass Index was calculated. Two-third of the women had normal BMI. A little more than 50% of the patients were multigravida. The frequency and type of vaginal colonization in women in active labor are given in Table 1.

Out of 150 women, 92 women (61.2%) showed vaginal colonization. Vaginal colonization was predominantly by gram-positive organisms in followed by a mixture of organisms and gram-negative organisms. The majority of women yielded coagulase-negative *Staphylococcus aureus* [CONS] followed by *Escherichia coli* in, methicillin-resistant *S. aureus* (MRSA) and methicillin-sensitive *S. aureus* (MSSA). The majority of the women who had vaginal colonization were in the 20-30 years age group and multigravida.

Chi-square test was done to find any association between colonization and various factors. There was no statistically significant difference observed between vaginal colonization with maternal age, socioeconomic status, body mass index, the period of gestation, term/preterm births, and birth weight of babies, whereas there was a statistically significant relationship between parity and vaginal colonization ($p=0.01$). None of the colonized women and their neonates developed puerperal or early-onset neonatal sepsis, respectively.

Table 1: Distribution of study participants based on aerobic bacteria isolated in high vaginal swabs

Type of organism	Frequency
Gram-positive organism	38 (25.3%)
a. CONS	19
b. MRSA	4
c. MSSA	3
d. Enterococcus spp.	2
Gram-negative organism	19 (12.6%)
a. E. coli	13

b. Klebsella pneumonia	3
c. Enterobacter spp.	2
Pseudomonas aeruginosa	1
A mixture of ≥ 2 organisms	32 (21.3%)
4. Contaminants	3 (0.02%)

Discussion

Normally vagina has commensal bacterial flora that undergoes dynamic changes during a woman's life. The vaginal micro biome is determined by vaginal pH that is less than 4.5 due to the production of lactic acid and availability of glucose for bacterial metabolism. The vaginal flora in prepubescent girls is populated by bifidobacterium due to neutral or alkaline vaginal pH whereas healthy women in the reproductive age group consist mostly of aerobic, lactobacilli that produce lactic acid. The production of lactic acid has indirect effects on pathogens and host defenses. Lactobacilli prevent long-term colonization of various pathogenic bacteria, e.g. *Neisseria gonorrhoeae*, *Escherichia coli*, *Gardnerella vaginalis*, *Peptostreptococcus*, and *Staphylococcus aureus*, not only by producing lactic acid but also by adhering to vaginal epithelial cells. Factors like menstruation, sexual intercourse, antibiotics, stress, and pregnancy cause changes in vaginal microbiology in the reproductive age group[8].

This change in bacterial flora can sometimes lead to asymptomatic or symptomatic bacterial vaginosis and to chorioamnionitis in pregnant women. Furthermore, the consequences are complications in the form of puerperal sepsis, EONS, and preterm labor[9]. In the present study, we focused only on the isolation of aerobic bacteria in vaginal colonization in low-risk asymptomatic pregnant women with intact membranes who presented to the tertiary-level hospital for delivery. The objective was to find out any increased risk of complications like puerperal sepsis and EONS in these subsets of low-risk pregnant women. In the study, CONS (gram-positive organism) was the most common single isolated organism whereas various studies have reported gram-negative bacteria predominantly[10]. The rate of vaginal colonization with maternal age was not found to be different in different age groups ($p=0.141$). But few studies have reported increased colonization with age, predominantly in >30 years of age [10] and some in <20 years of age[11]. We did not find any relation between vaginal colonization and BMI ($p=0.986$) whereas others had found a higher BMI to be a significant risk factor for GBS colonization[12].

In the present study, we did not find any association between vaginal colonization detected in active labor with puerperal sepsis also. In our study, the vaginal samples were collected in low-risk women while we excluded women with high-risk factors such PROM, PPRM, chorioamnionitis, maternal fever within seven days before active labor, immunocompromised state such as HIV, and five or more vaginal examinations that are generally the risk factors for puerperal and neonatal infections.

Conclusion

Neonatal sepsis is one of the major causes of mortality and morbidity in neonates. Early onset neonatal sepsis (EONS) is a severe condition with high mortality rate. EONS commonly caused by maternal microorganism before or during the delivery process. Moreover, mother's genital tract microorganisms also contribute in EONS incidence. Here was no correlation between vaginal bacterial colonization and EONS incidence.

References

1. Stoll BJ. Infections of the Neonatal Infant. In: Kliegman, Behrman, Jenson, Stanton, editors. Nelson textbook of Pediatrics. 18th ed. Philadelphia: Elsevier; 2007. p. 794.
2. Child Health Research. Project special report: Reducing perinatal and neonatal mortality, report of a meeting. Baltimore, Maryland. 1999; 6-12.
3. Leal YA, Nemegeyi JA, Velázquez JR, et al. Risk factors and prognosis for neonatal sepsis in south eastern Mexico. BMC Pregnancy Childbirth 2012; 12: 48.

4. Yoon BH, Romero R, Moon JB, Shim SS, Kim M, Kim G, Jun JK. Clinical significance of intra-amniotic inflammation in patients with preterm labor and intact membranes. *Am J Obstet Gynecol.* 2001 Nov;185(5):1130-6.
5. A DwiBahagiaFebriani, Andi Handriyati, EmaAlasiry, DasrilDaud. The correlation between the mothers' vaginal bacterial colonization and incidence of early onset neonatal sepsis. *CurrPediatr Res* 2017; 21 (1): 105-111.
6. Klein J, Marcy M. Bacterial sepsis and meningitis. In Remington J, Klein J eds. *Infectious Diseases of the Fetus and Newborn Infant*, Ed 4. Philadelphia, WB Saunders, 1995; 835-890.
7. Squire E, Favara B, Todd J. Diagnosis of neonatal bacterial infection: hematologic and pathologic findings in fatal and nonfatal cases. *Pediatrics.* 1979 Jul;64(1):60-4.
8. The changing landscape of the vaginal microbiome. Huang B, Fettweis JM, Brooks JP, Jefferson KK, Buck GA. *Clin Lab Med.* 2014;34:747-761.
9. Diagnosis and management of clinical chorioamnionitis. Tita AT, Andrews WW. *ClinPerinatol.* 2010;37:339-354.
10. Vaginal colonisation of women in labour with potentially pathogenic bacteria: a cross-sectional study at three primary health care facilities in Central Uganda. Tumuhamy J, Steinsland H, Tumwine JK, et al. *BMC Infect Dis.* 2020;20:98.
11. Prevalence and risk factors of group B Streptococcus colonisation in intrapartum women: a cross-sectional study. Akkaneeermsaeng W, Petpichetchian C, Yingkachorn M, Sasithorn S. *J ObstetGynaecol.* 2019; 39:1093-1097.
12. Chen Z, Wen G, Cao X, et al Group B streptococcus colonisation and associated risk factors among pregnant women: a hospital-based study and implications for primary care.. *Int J ClinPract.* 2021;73:0.

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