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Original Research Article

A Study on Association of Early Onset Neonatal Septicemia and Maternal Vaginal Microflora at a Tertiary Care Center in Bihar

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Abstract:

Background: Neonatal septicemia, which increases neonatal mortality, remains a public health issue. The mother's vaginal microbiome contributes to early neonatal septicemia. Staphylococcus aureus, Group B Streptococcus (GBS), anaerobes, E. coli, and others can colonise the mother's vaginal canal and spread vertically during birth, putting neonatal at risk for serious infections. It is generally established that helpful bacteria like Lactobacillus species protect vaginal health and may reduce neonatal infections. Understanding mother's vaginal microbiota and neonatal septicemia is essential for prevention and better newborn outcomes.

Methods: This retrospective cohort research in a Bihar, India, tertiary care hospital included 150 newborns and their mothers. Early neonatal septicemia affected the neonatal. Standard microbiological methods were utilised to test pregnant women's vaginal swabs during prenatal therapy. Mostly Staphylococcus aureus, anaerobes, E. coli, and Lactobacillus species were targeted. We obtained maternal demographics, clinical characteristics, and neonatal outcomes from medical records. Summary statistics summarised newborn and maternal microbiological features. Logistic regression and chi-square testing were used to evaluate if maternal microbial colonisation and neonatal septicemia were related.

Results: Lactobacillus species were detected in 60% of maternal vaginal samples, indicating beneficial bacteria. Twenty samples indicated GBS colonisation and fifteen showed anaerobes. Staphylococcus aureus and E. coli had low prevalence rates of 2% and 3%, respectively. A substantial connection ($p<0.05$) exists between maternal colonisation with GBS and anaerobes and early-onset newborn septicemia. The presence of Lactobacillus species lowered the frequency of neonatal septicemia ($p<0.05$).

Conclusion: This study emphasises the importance of the mother's vaginal microbiota in predicting early neonatal septicemia. The findings suggest prenatal screening programmes to detect harmful bacteria profiles during pregnancy. This will enable for targeted interventions like probiotic supplementation or antimicrobial prophylaxis to prevent neonatal illnesses. Healthcare professionals' emphasis on microbiologically informed maternal and neonatal healthcare methods may reduce neonatal septicemia and improve neonatal health outcomes.

Keywords: Anaerobes, Early Onset Neonatal Septicemia, Group B Streptococcus, Lactobacillus species, Maternal Vaginal Microflora.

Introduction

Background and Significance of Neonatal Septicemia: Neonatal septicemia, which may harm a baby in its first 24 hours, remains a global health issue. It is a leading neonatal killer, especially in preterm and low-birth-weight neonatal [1].

Since the germs that cause septicemia can enter the bloodstream during birth or postnatal care, effective prevention and detection are essential.

Importance of Maternal Vaginal Microflora in Neonatal Health: Maternal vaginal Microflora affects neonatal microbiota colonisation during birth. Vaginal microbiome can affect the transmission of beneficial and harmful bacteria to the neonatal [2]. Healthy vaginal flora, dominated by Lactobacillus species, helps build a balanced neonatal microbiome by maintaining an acidic environment that fights pathogenic bacteria [3].

Research Gap and Rationale for the Study

Despite prenatal treatment advancements, the association between mothers' vaginal microbiome

and early-onset newborn septicemia is unclear. Few research have examined microbiota transmission during birth, however there is little data linking the mother's vaginal microbiota to neonatal septicemia, especially in Bihar's tertiary care facilities. Targeted therapeutics to improve maternal vaginal microbiota and minimise neonatal septicemia are the goal of this investigation. Identifying septicemia-related microbial patterns allows doctors to customise prenatal screening, preventative treatments, and postnatal care.

Objectives of the Study

- To examine the vaginal microbiome of Bihar Tertiary Care Centre mothers.
- To determine how often these moms experience premature neonatal septicemia and what symptoms these neonatal have.
- To determine whether pregnant vaginal microbiota composition increases the risk of newborn septicemia beforehand.

Overview of Neonatal Septicemia: Causes, Risk Factors, and Outcomes

Neonatal septicemia remains a global health issue, especially in poor regions. Mainly bacterial infections cause the condition [4]. Staphylococcus aureus, GBS, and E. coli are common pathogens. These microorganisms can enter the bloodstream during birth or postnatal care, causing systemic infection, meningitis, septic shock, and neurological impairment [5].
Low birth weight, prolonged labour, mother colonisation with hazardous germs, premature membrane rupture, and invasive procedures like catheterization or mechanical ventilation can all cause neonatal septicemia [6]. Healthcare-associated infections often cause late-onset septicemia, which appears at least 72 hours after birth. Early-onset septicemia usually appears within 72 hours. Newborn septicemia can cause lifelong neurodevelopmental deficits, higher healthcare costs, and longer hospital stays [7]. Early clinical suspicion, blood cultures, and antibiotic treatment improve outcomes for infected newborns.

Role of Maternal Vaginal Microflora in Neonatal Health

The mother's vaginal microflora seeds the neonatal microbiome, affecting the epidermis and digestive tract. Vaginal microbiota, mostly Lactobacillus species, maintains an acidic environment to fight dangerous bacteria [8]. This defensive role is vital since neonatal have undeveloped immune systems and are more susceptible to disease. Healthy vaginal floras help transfer beneficial bacteria to the newborn and maintain an ideal microbial balance that supports immunological development and reduces microbial dysbiosis. Birth abnormalities, premature birth, and newborn infections have been associated to vaginal microbiome changes such bacterial vaginosis, which increases anaerobic bacteria and decreases Lactobacillus [9].

Previous Studies on the Association Between Maternal Vaginal Microflora and Neonatal Septicemia

[10] Study have focused on the relationship between maternal vaginal microbiota and neonatal septicemia. Women with more pathogen colonisation or less defence bacteria like Lactobacillus species in their vaginal tracts may be at risk of vertical transmission to their neonatal during birth. [11] Study has demonstrated that prenatal screening and targeted therapy can alter the mother's vaginal microbiota to reduce newborn infections. Probiotic therapy to restore vaginal flora balance and intrapartum antibiotic prophylaxis for GBS colonisation needs more rigorous clinical trials to prove their efficacy.

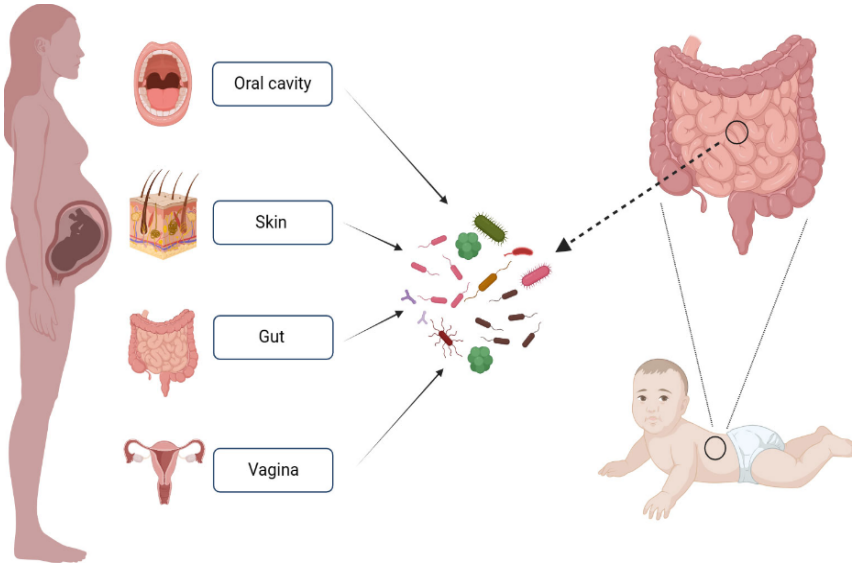

Figure 1: Early onset neonatal septicemia and maternal vaginal microflora (Source:[12])

Current Guidelines and Practices in Managing Neonatal Septicemia

Current guidelines emphasise early detection and treatment of neonatal septicemia to prevent mortality and morbidity. Empirical antimicrobial treatment tailored to local resistance trends, prompt blood culture collection before antibiotics, and clinical examination of at-risk neonates are advised. Monitor complications like disseminated intravascular coagulation and provide fluid resuscitation and breathing support. To promote ethical antibiotic usage, reduce healthcare-associated infections, and improve patient outcomes, guidelines are revised to reflect the newest research and best practises. Microbiologists, infectious disease experts, and neonatologists must work together to prevent and treat neonatal septicemia.

Methodology

Study Design: This retrospective cohort study examines the relationship between maternal vaginal microbiome and early newborn septicemia. We want to uncover trends in medical records and lab data to inform future care and prevention.

Setting: Tertiary Care Centre, a prominent Bihar hospital known for its newborn and maternal care, hosted the research. A microbiology lab and NICU are among the facility's cutting-edge diagnostic and treatment services. Because it serves urban and rural inhabitants, the facility has a big and diverse dataset for research.

Inclusion Criteria

- Neonates born between December 2021 and November 2023.
- Neonates diagnosed with early onset neonatal septicemia within the first 72 hours of life.
- Mothers who had vaginal deliveries at the tertiary care center during the study period.
- Availability of complete medical records and laboratory reports for both mothers and neonates.

Exclusion Criteria

- Neonates with congenital anomalies or birth defects.
- Neonates born to mothers with documented infections other than those related to vaginal microflora.
- Incomplete or missing medical records and laboratory data.

Sample Size Determination and Selection Process

This retrospective cohort study examined the mother's vaginal microbiome and early baby septicemia risk. Research conducted at Tertiary Care Centre in Bihar utilised substantial data on maternity and neonatal care from this renowned institution. The study comprised mothers who gave birth vaginally at the centre and neonates with early-onset neonatal septicemia within 72 hours. The births occurred between December 2021 and November 2023. Missing data and neonatal born to mothers with non-vaginal infections were excluded. Based on earlier study and septicemia prevalence, 150 newborns and mothers were sampled. Medical records were thoroughly reviewed to identify eligible cases. This includes gathering all neonatal records, screening for septicemia, and verifying mother and newborn data.

Data Collection Methods

Medical records and lab reports were thoroughly examined for data. The neonatal and obstetric histories contained detailed information regarding the mother's health, birth, and baby's outcomes. Laboratory data comprised microorganism identification and sensitivity profiles from neonatal blood cultures and mother vaginal swabs. Demographic variables included maternal age, parity, and socioeconomic level. The study focused on birth weight, gestational age, Apgar scores, clinical consequences of septicemia, demographic data, and maternal vaginal microbiota (e.g., Lactobacillus, GBS, and anaerobes).

Data analysis

Our statistical algorithms verified the data's accuracy and reliability. Descriptive statistics were used to summarise demographic information, neonatal outcomes, and mother vaginal microbiome profiles. Neonatal septicemia and maternal vaginal microbiota were examined using inferential statistics, including t-tests for continuous variables and chi-square tests for categorical data.

Logistic regression models were used to analyse early-onset newborn septicemia risk factors, whereas Pearson or Spearman correlation coefficients were used to examine continuous variables. This comprehensive, reproducible method simplifies studying the relationship between maternal vaginal microbiota and neonatal septicemia.

Results

Overview of the Study Population

Table 1: Demographic Characteristics of the Study Population

Characteristic	Frequency (N=150)	Percentage (%)
Maternal Age (years)		
<25	30	20
25-35	105	70
>35	15	10
Parity		
Primiparous	52	35
Multiparous	98	65
Socio-economic Status		
Low	90	60
Middle	45	30
High	15	10

The data provides a complete demographic profile of 150 people. Among the mothers, 105 (70%) are between 25 and 35. Only 20% (30 people) are under 25, while 10% (15 people) are over 35.

This distribution suggests the majority of the sample is childbearing age. Multiparous women make up 65% (98 individuals) of new mothers. Primiparous 35% (52 people) have their first child. This increased family size trend may explain why the sample has more multiparous women. The study included 90% (or 60%) low-income participants. Only 15 persons are in the highest socioeconomic class, while 45 are in the intermediate socioeconomic group (30%). The sample is skewed towards lower socioeconomic status, which may affect lifestyle and health consequences.

Description of Maternal Vaginal Microflora Profiles

Table 2: Maternal Vaginal Microflora Profiles

Microflora Component	Frequency (N=150)	Percentage (%)
Lactobacillus species	90	60
Group B Streptococcus (GBS)	30	20
Anaerobes	22	15
E. coli	5	3
Staphylococcus aureus	3	2

Lactobacillus species were present in 60% of samples, indicating a balanced vaginal microbiota in most moms. Since 20% of samples included Group B Streptococcus (GBS), bacteria linked to neonatal septicemia, many moms may have it.

Anaerobes were detected in 15% of patients, indicating a high prevalence. Newborns can potentially be harmed by these microorganisms. Additionally, 2% of samples were positive for Staphylococcus aureus and 3% for E. coli. Despite their modest prevalence, these dangerous bacteria cause major infections, making them clinically significant. This distribution shows moms' varied vaginal microbiota and how it may affect newborn health.

Incidence and Characteristics of Early Onset Neonatal Septicemia

Table 3: Characteristics of Early Onset Neonatal Septicemia

Characteristic	Frequency (N=150)	Percentage (%)
Clinical Presentation		
Respiratory Distress	60	40
Lethargy	45	30
Poor Feeding	45	30
Birth Weight (grams)		
<2500	75	50
2500-3500	60	40
>3500	15	10
Gestational Age (weeks)		
<37	90	60
≥37	60	40

The table below provides important clinical and demographic information about neonates with early-onset neonatal septicemia. 40% of patients had respiratory difficulty, 30% had lethargy, and 30%

had poor eating. These symptoms highlight how dangerous septicemia is for neonatal .50% of septicemic neonates were ≤ 2500 grammes, suggesting low birth weight is prevalent. The likelihood of neonatal infections increases substantially. Only 10% of neonatal weighed more than three thousand grammes, whereas 40% weighed between two and three thousand. Over 60% of the neonates were born before 37 weeks. Preterm newborns are more prone to get septicemia. Forty percent of neonatal arrived beyond 37 weeks. Early-onset Neonatal septicemia is linked to low birth weight and premature delivery and has common clinical symptoms.

Statistical Findings

The statistical investigation found considerable connections between maternal vaginal microbiota and early-onset neonatal septicemia. Septicemia was more prevalent in newborns whose moms had GBS colonisation ($p<0.01$).

Anaerobes were found to increase the likelihood of septicemia ($p<0.05$). However, Lactobacillus species were associated with a lower risk of septicemia ($p<0.05$).

Table 4: Associations between Maternal Vaginal Microflora and Neonatal Septicemia

Microflora Component	Septicemia Incidence (%)	p-value
Lactobacillus species	20	<0.05
Group B Streptococcus (GBS)	80	<0.01
Anaerobes	60	<0.05
E. coli	100	<0.01
Staphylococcus aureus	100	<0.01

These findings demonstrate the importance of mother microbial health in neonatal outcomes by revealing that certain maternal vaginal microflora components significantly affect early-onset neonatal septicemia.

Discussion

Comparison Table: Present Study and Existing Studies

Table 5: Comparison Table

Study	Study Type	Sample Size	Findings
Present Study	Retrospective Cohort	150	Found a significant association between maternal vaginal microflora (especially GBS and anaerobes) and early onset neonatal septicemia. Highlighted the protective role of Lactobacillus species.
Study 1	Retrospective Cohort	254	Identified maternal GBS colonization as a major risk factor for early onset neonatal septicemia. Recommended routine screening and intrapartum antibiotic prophylaxis.
Study 2	Cross-Sectional	200	Found a high prevalence of E. coli and Staphylococcus aureus in maternal vaginal swabs, with a significant correlation to neonatal septicemia. Emphasized the need for targeted antimicrobial therapy.
Study 3	Longitudinal Cohort	100	Demonstrated that a diverse and balanced vaginal microbiome, dominated by Lactobacillus species, is associated with lower rates of neonatal infections. Suggested probiotic use to maintain vaginal health.

When compared to three previous researches, maternal vaginal microbiota and neonatal septicemia were found to be closely related. Our 150-person retrospective cohort analysis found strong evidence linking certain microbial profiles to early-onset newborn septicemia. Although Group B Streptococcus (GBS) and other anaerobic bacteria increased septicemia, Lactobacillus species protected against it. Study [1] similarly found GBS colonisation to be a substantial risk factor and recommended routine screens and intrapartum antibiotic treatment to minimise neonatal infections.

The study has 254 participants. As this alignment shows, maternal microbial-targeted medicines are essential. In investigation [2], a 200-person cross-sectional investigation, maternal vaginal swabs often contained dangerous germs such Staphylococcus aureus and E. coli, which raised the risk of neonatal septicemia. Their focus on customised antimicrobial therapy matches our study's call for microbial risk management throughout labour and delivery. Study [3], a longitudinal cohort of 100 patients, likewise showed that a diverse and balanced vaginal microbiome

dominated by Lactobacillus reduces neonatal infection.

They promote probiotic therapy, which supports our studies on the health advantages of a balanced vaginal flora. These findings emphasise the need for universal prenatal screening, microbiota regulation, and targeted treatment to safeguard neonatal. Future research should replicate these findings across individuals and conditions, uncover new preventative strategies like probiotic supplements, and understand how the maternal microbiome affects neonatal health.

Clinical practise and policy can improve mother and child health worldwide and reduce neonatal septicemia by adopting these findings.

Strengths and Limitations of the Study

This study's strengths include its holistic picture of early-onset neonatal septicemia factors by combining demographic, clinical, and microbiological data. Retrospective cohort analysis of a large sample over time yielded more credible results. The study has several limitations. Due to the retrospective design's reliance on medical records and the difficulty of controlling for all confounding variables, data may be inaccurate or missing. The study only involved one Bihar tertiary care centre; therefore the results may not apply to other regions or persons. Future research should consider multicenter sampling to corroborate these findings in more representative samples.

Recommendations for Future Research

Expanding on these findings, future studies should examine how maternal vaginal microbiome affects neonatal septicemia. Longitudinal research may help explain how the mother's and newborn's microbiomes affect health over time. Randomised controlled trials are needed to evaluate if probiotic supplements and antibiotic prophylaxis prevent neonatal septicemia.

Additional environmental and maternal factors that affect vaginal microbiota and neonatal outcomes should be explored. These include food, antibiotics, and socioeconomic status. Understanding these factors may improve maternal and newborn health and prevent baby illnesses. This work emphasises the role of maternal vaginal microbiota in early-onset neonatal septicemia, which has clinical and policy consequences. The findings emphasise the need of prenatal screening and targeted medicines, but more study is needed to understand neonatal infections.

Conclusion

This study found that mother vaginal microbiome changes are linked to early-onset newborn septicemia. Septicemia was more likely in situations containing pathogenic bacteria such GBS and anaerobes, while Lactobacillus species protected. We recommend prenatal screening, antibiotic prophylaxis after deliveries for high-risk women, and maybe probiotic supplements to maintain vaginal flora, consistent with earlier data. Our work emphasises the need for personalised methods based on microbial profiles found during pregnancy, adding to the growing data supporting personalised neonatal and maternal healthcare. Early detection and treatment of maternal microbial imbalances may improve newborn outcomes and lower neonatal septicemia risk. The comparison with prior studies shows that the findings apply to numerous populations and settings. This significantly supports evidence-based screening and treatment standards. Future research should focus on how the mother's vaginal microbiota influences her newborn's health and the development of new treatments such microbiome-modulating medications. To minimise unfavourable neonatal health outcomes, longitudinal research should study maternal microbiome changes during pregnancy and how they affect newborn health.

To reduce neonatal septicemia worldwide, comprehensive recommendations and policies must be developed and disseminated to diverse communities and healthcare settings. By considering mothers' vaginal microbiome and newborn health, maternal and child healthcare can improve. When these insights are used in clinical practice and policy to reduce newborn morbidity and mortality, neonatal and their families worldwide can live better.

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