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Original Research Article

Obstetric Complications, Antenatal Characteristics, and Intrapartum Exposure Tracks Triggering Early-Onset Neonatal Sepsis (EONS) in a Public Tertiary Healthcare Hub

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Abstract

Objective: To identify the obstetric complications, antenatal characteristics, and immediate intrapartum exposure tracks that trigger early-onset neonatal sepsis (EONS) in a public tertiary healthcare hub.

Methods: This prospective institutional observational study tracked mother–neonate pairs over an 18-month duration at government hospital of central India. Maternal demographics, antenatal clinic care logs, rupture of membrane timelines, and amniotic patterns were cataloged for cases where infants developed clinical or laboratory-confirmed systemic infection within 72 hours of life. Venous blood cultures were used to confirm specific bacterial flora.

Results: A total of 170 mother–neonate pairs were included. Suboptimal antenatal care was a prominent risk marker, with 44.7% (n = 76) of mothers completing fewer than four routine antenatal visits. Prominent intrapartum risk factors driving transmission included prolonged rupture of membranes (≥18 hours) in 32.9% (n = 56), prolonged labor in 40.0% (n = 68), and meconium-stained amniotic fluid in 17.6% (n = 30). Neonatal vulnerability correlated strongly with low birth weight (70.0%; n = 119) and prematurity (47.1%; n = 80). Venous blood culture positivity was 20.6% (n = 35), with Staphylococcus aureus isolated as the predominant pathogen.

Conclusions: Early systemic neonatal infection is directly linked to identifiable and manageable maternal indicators, notably unbooked status, maternal infections, and prolonged membrane rupture. Improving access to routine prenatal care and ensuring timely intrapartum antibiotic coverage for prolonged PROM are crucial steps to lower infant mortality.

Keywords: Early-Onset Neonatal Sepsis; Maternal Risk Factors; PROM; Antenatal Care.

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Introduction

Pregnancy represents one of life's most profound transformative journeys. However, the diagnosis of early-onset neonatal sepsis (EONS) creates a stark contrast, abruptly transforming maternal joy into systemic trauma. Neonatal sepsis, characterized by a severe systemic inflammatory response to an infectious cause within the initial month of life, constitutes a major global health challenge.

Globally, it affects an estimated 1.3 to 3.9 million neonates annually, with a heavily disproportionate burden falling on low- and middle-income countries (LMICs), where it drives 11% to 34% of neonatal mortalities. India continues to grapple with a high Neonatal Mortality Rate (NMR) of 24.9 per 1,000 live births, with bacterial sepsis serving as a primary contributor due to challenges like overcrowding, socioeconomic constraints, and referral delay. Crucially, neonatal sepsis is sub-classified by timing: early-onset neonatal sepsis (EONS) occurs within the first 72 hours of life and is primarily mediated via vertical transmission of pathogens from the maternal genital tract to the foetus. Pathogens ascend into the amniotic cavity or contaminate the birth canal during labor, easily overwhelming the newborn's immature immune system. This vulnerability is characterized by compromised neutrophil chemotaxis and deficient humoral barriers in the newborn. High-risk maternal

elements like chorioamnionitis, untreated urinary tract infections (UTIs), prolonged labor, and prolonged premature rupture of membranes (PROM) significantly amplify this infectious cascade. Given that clinical presentations vary markedly between distinct hospital setups, this prospective institutional audit was designed to map the specific clinical risk factors and bacterial flora seen in a high-volume public tertiary centre.

Material and Methods

This institution-based observational study was conducted within the Department of Obstetrics and Gynaecology at Gandhi Medical College and associated Sultania Zanana Hospital, Bhopal, over an 18-month duration. Formal ethical clearance was obtained from the Institutional Ethics Committee before initiating data collection, and informed written consent was routinely gathered from all participating mothers.

Inclusion and Exclusion Criteria: The study sample comprised pregnant women admitted for delivery whose neonates subsequently developed clinically apparent or laboratory-confirmed systemic sepsis within the first 72 hours of life. Neonates presenting with late-onset sepsis patterns (>72 hours), infants displaying severe congenital anatomical malformations, or those delivered at external private setups prior to transfer were excluded from analysis.

Data Collection and Clinical Parameters: Detailed maternal demographic profiles (including age distribution and gravida status) were documented alongside structural healthcare indexes, specifically the total number of completed antenatal care (ANC) visits. Crucial intrapartum risk variables were closely monitored, including total duration of labor, mode of delivery, occurrence of prolonged premature rupture of membranes (PROM ≥18 hours), and meconium contamination of the amniotic fluid. Corresponding neonatal parameters recorded at birth included gestational age, exact birth weight, gender distribution, and baseline physical health tracking.

Laboratory Protocols: Under strict sterile conditions, venous blood samples were drawn from symptomatic neonates before starting empirical antibiotic therapy. These samples were processed through standard automated blood culture bottles to isolate specific causative bacteria.

Statistical Evaluation: Continuous baseline parameters were expressed as mean values with standard deviations. Discrete categorical variables were reported using frequencies (n) and percentages (%). Statistical correlations evaluating maternal characteristics against neonatal infection tracks were analyzed using descriptive statistics, with significance set at a p-value of < 0.05.

Results

A total of 170 mother–neonate pairs were systemically evaluated over the 18-month study duration. The mean maternal age was 25 years, with a major concentration of 81.2% (n = 138) clustered within the 20–30 years range. Multigravida mothers constituted 52.9% (n = 90) of the cohort, while primigravida status accounted for 47.1% (n = 80). Antenatal care tracking revealed notable gaps in routine health utilization; 44.7% (n = 76) of the mothers completed fewer than four routine antenatal visits before delivery (Table 1).

Table 1: Maternal Socio-Demographic & Obstetric Risk Profiles (N = 170)

S. No.	Maternal Characteristics	Patient Volume (n)	Allocation (%)
1	Maternal Age Index (20–30 Years)	138	81.2%
2	Other Age Cohorts	32	18.8%
3	Multigravida Status	90	52.9%
4	Primigravida Status	80	47.1%
5	Inadequate Care (<4 Regular Visits)	76	44.7%
6	Adequate Care (≥4 Regular Visits)	94	55.3%

Evaluation of intrapartum factors demonstrated a high frequency of complications among the included pairs.

Prolonged rupture of membranes (PROM ≥18 hours) occurred in 32.9% (n = 56) of cases. Labor duration between 12 and 18 hours was noted in 40.0% (n = 68) of deliveries, and 17.6% (n = 30) presented with meconium-stained amniotic fluid.

Regarding delivery tracks, 47.6% (n = 81) required lower segment cesarean sections (LSCS), while 52.4% (n = 89) delivered via the standard vaginal route (Table 2).

Neonatal tracking parameters showed that a substantial majority of infants with early sepsis features had underlying physical vulnerabilities. Low birth weight (LBW <2500 g) was documented in 70.0% (n = 119) of newborns, and preterm delivery (<37 weeks) occurred in 47.1% (n = 80) of cases. Male neonates made up 61.8% (n = 105) of the population. Objective laboratory evaluation confirmed a venous blood culture positivity rate of 20.6% (n = 35) among symptomatic infants, with

species of Staphylococcus aureus identified as the primary isolated pathogens.

Table 2: Intrapartum Exposures & Clinical Neonatal Outcomes (N = 170)

S. No.	Risk Indicators & Clinical Outcomes	Patient Volume (n)	Allocation (%)
1	Prolonged Rupture of Membranes (≥18 hours)	56	32.9%
2	Active Prolonged Labor Duration (12–18 hours)	68	40.0%
3	Meconium-Stained Amniotic Fluid Parameters	30	17.6%
4	Lower Segment Cesarean Section (LSCS) Route	81	47.6%
5	Standard Vaginal Delivery Route	89	52.4%
6	Structural Low Birth Weight (LBW <2,500 g)	119	70.0%
7	Premature Delivery Presentation (<37 weeks)	80	47.1%
8	Male Gender Cohort	105	61.8%

Discussion

The results of this prospective institutional study highlight the direct link between maternal intrapartum complications and early-onset neonatal sepsis. Our data matches current epidemiological frameworks showing that missing standard antenatal visits leaves maternal genitourinary tracks unmonitored, increasing the risk of vertical transmission.

The presence of PROM remains a primary risk factor in our study cohort. When the protective amniotic barrier is compromised, ascending vaginal bacteria can infect the uterine environment, exposing the fetus through the aspiration of contaminated fluid. This pathobiology mirrors findings by Ahmed et al. [1], who noted that membrane rupture was the primary maternal factor in 64.8% of early sepsis cases, as well as Jameel et al. [2], who reported a strong link between PROM and early infant infections. Obstetric evaluations by Noah et al. [3], Chauhan et al. [4], and Salama et al. [5] further match the findings that low ANC tracking networks and operative labor routes expand vertical transmission vulnerabilities.

Maternal tracking profiles from clinical trials by Mersha et al. [6] and Adatara et al. [7] demonstrate that labor patterns compromise neonate protection. Our analysis confirms that prematurity and low birth weight compound these risks. Preterm infants lack complete transplacental antibody protection and have fragile skin barriers, rendering them highly vulnerable to ascending infections. The baseline presence of depressed clinical tracks highlighted by Mogollón et al. [8], Lakshmi et al. [9], and Alcocer et al. [10] matches the tracking patterns seen during our hospital audit. The microbiological dominance of Staphylococcus aureus in our culture-positive cases aligns with trends compiled by Rafi et al. [11], presenting an interesting, localized profile that highlights changing resistance patterns and the absolute necessity for constant hospital surveillance.

Strengths and Limitations: This prospective study provides updated, localized epidemiological context from a high-volume public hospital, helping refine empirical treatment choice guidelines. However, as a single-center observational audit, the results may not reflect public health patterns across smaller, remote rural clinics. Additionally, the presence of fastidious bacteria may lead to false-negative blood cultures, underrepresenting the true pathogen burden.

Conclusion

Early-onset neonatal sepsis is closely tied to manageable maternal risk factors, particularly poor antenatal tracking, maternal genitourinary infections, and prolonged membrane rupture. Improving public access to prenatal care, ensuring early screening for maternal infections, and using timely intrapartum antibiotic coverage are crucial strategies to lower infant mortality.

Author Contributions, Declarations & Statements: All data extraction and clinical testing were performed strictly using standard public hospital infrastructure at Gandhi Medical College, Bhopal.

Ethical Approval and Informed Consent: This study was performed in line with the principles of the Declaration of Helsinki. The study was approved by the Institutional Ethics Committee of Gandhi Medical College, Bhopal, Letter No. 18895/MC/IEC/2023 dated 8/5/23. Informed written consent was systematically obtained from the parents or legal guardians of all participating infants before data logging.

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