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Microbiologic Etiology and Infant Factors Associated with Early Onset Neonatal Bacteremia at the Mount Sinai Hospital

PUBLISHED ABSTRACT

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ABSTRACT

Background/Rationale: Early-onset neonatal sepsis (EOS) is often acquired through vertical transmission and is an important cause of morbidity and mortality in infants. The etiology of neonatal sepsis has changed over time, and the intrapartum management of women at risk for infection has been shown to improve neonatal outcomes.

Hypothesis or Research Question: To identify the microbiologic etiology of organisms causing EOS and evaluate the impact of maternal illness, labor and delivery practices, and postnatal factors on EOS rates at Mount Sinai Hospital (MSH).

Study Design/Methods: An IRB approved descriptive retrospective chart review of cases of EOS in infants less than 7 days of age at MSH from 2015–2018 was conducted. A total of 41 infants were identified. Clinical charts were reviewed and classified into two groups based on age at time of presentation: very early onset sepsis (VEOS) (age days 0–2) and delayed early onset sepsis (DEOS) (age days 3–7). Corresponding maternal charts were also reviewed to identify obstetric risk factors and whether at-risk mothers received appropriate intrapartum prophylaxis.

Results: In the VEOS group, 41% of cases were caused by Group B Streptococcus (GBS), 30% by *E.coli*, and 18% by other *Streptococci*. In the DEOS group, 33% of cases were coagulase-negative *Staphylococci*, 27% *E.coli*, and 20% *S. aureus*. There were no cases of GBS among the DEOS group. On average, VEOS occurred in term infants (37.40 ± 4.41 weeks) with a normal weight (2840 ± 88g), while DEOS occurred in preterm infants (30.74 ± 6.08 weeks) with a low birth weight (1550 ± 104g). 36.4% of GBS isolates demonstrated resistance to clindamycin. *E.coli* isolates demonstrated resistance to ampicillin/sulbactam (66.7%), co-trimoxazole (41.7%), and gentamicin (35%).

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neonatal bacteremia; E.coli sepsis; GBS sepsis; antibiotic resistance; GBS prophylaxis; early-onset neonatal sepsis

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No extended spectrum beta-lactamase-producing *E.coli* isolates were found in the VEOS or DEOS groups. Within the GBS EOS cases, 63.6% of infants who developed GBS EOS were born to women with a documented GBS negative screening test.

Conclusions/Future Plans: The microbiologic etiology of VEOS and DEOS varied, with GBS only identified in the VEOS group and *E.coli* common in both the VEOS and DEOS groups. The failure to identify GBS colonization in women who give birth to infants that develop GBS EOS requires further exploration. Our study demonstrates the need for both strategies to reduce the risk of *E.coli* EOS among preterm, low birth weight neonates, as well as further investigation into *E.coli* EOS resistance patterns.

Table 1 Demographics for All Patients.

VARIABLES	ALL PATIENTS (N = 41)
	MEAN ± SD OR N (%)
Gender	
Male	20 (48.7)
Female	21 (51.2)
Birthweight, grams	2.435 ± 109
Gestational age, weeks	35.24 ± 5.86
Age at Time of First Positive Blood Culture, days	1.78 ± 2.51
Site of Blood Culture	
NICU	28 (68.3)
Well Baby Nursery	5 (12.2)
PICU	0 (0)
PCICU	1 (2.4)
ED	1 (2.4)
Pediatric Floors	0 (0)
Other	6 (14.6)

Tabic 2 Gestational Age, Birthwcight, and Susceptibility Stratified by Organism.

ORGANISMS	MEAN ± SD OR NUMBER OF CASES (%)
Group B *Streptococcus* (n = 11)	
Gestational Age, weeks	38.62 ± 3.60
Birthweight, grams	2960 ± 58
Susceptible to Clindamycin	6 (54.5%)
Resistant to Clindamycin [MIC ≥256 mcg/mL]	4 (36.4%)
Sensitivity to Clindamycin Unavailable	1 (9.1%)
Macrolide-Inducible Resistance (D-test) – Positive	2 (18.1%)
E. coli (n = 12)	
Gestational Age, weeks	34.87 ± 6.05
Birthweight, grams	2270 ± 105
Resistant to Ampicillin (MIC ≥32 mcg/mL)	6 (50%)
Resistant or Intermediate to Ampicillin-Sulbactam (MIC ≥16 mcg/mL)	8 (66.7%)
Resistant to Trimethoprim-Sulfamethoxazole (MIC ≥320 mcg/mL)	5 (41.7%)
Resistant to Gentamicin [MIC ≥16 mcg/mL]	3 (25%)
Resistant to Piperacillin/Tazobactam (MIC ≥128 mcg/mL)	1 (8.3%)

(Contd.)

ORGANISMS	MEAN ± SD OR NUMBER OF CASES (%)
Resistant to Ciprofloxacin (MIC ≥4 mcg/mL)	1 (8.3%)
Resistant to Levofloxacin (MIC ≥8 mcg/mL)	1 (8.3%)
Macrolide-Inducible Resistance (D-test) – Positive	0 (0%)
Oxacillin Resistance	0 (0%)
ESBL Pattern	0 (0%)
Staphylococcus aureus (n = 3)	
Gestational Age, weeks	27.27 ± 4.12
Birthweight, grams	1090 ± 620
Oxacillin Susceptible (MSSA)	3 (100%)
Oxacillin Resistant (MRSA)	0 (0%)
MSSA isolates Resistant to Clindamycin (MIC ≥256 mcg/mL")	0 (0%)
MRSA isolates Susceptible to Clindamycin	3 (100%)
Enterococcus faecalis (n = 2)	
Gestational Age, weeks	40.45 ± 0.07
Birthweight, grams	3420 ± 184
Susceptible to Ampicillin	2 (100%)

Tabic 3 Clinical Factors Stratified by Blood Culture Result for Early Onset Sepsis (0 to 7 Days) (N = 45).

	GBS (N = 11)	E. COLI (N = 12)	OTHER PATHOGENS (N = 22)
	Mean ± SD or N (%) or Median (IQR)	Mean ± SD or N (%) or Median (IQR)	Mean ± SD or N (%) or Median (IQR)
Demographics			
Gender			
Male	4 (36.4)	5 (41.7)	11 (50)
Female	7 (63.6)	7 (58.3)	11 (50)
Birthweight, grams			
<1500 g	1 (9.1%)	5 (41.7%)	10 (45.4%)
1501–2500 g	0 (0%)	2 (16.6%)	3 (13.6%)
>2500 g	10 (90.9%)	5 (41.7%)	9 (41.0%)
Gestational age, weeks	38.62 ± 3.60	34.87 ± 6.05	33.65 ± 6.20
<37 weeks	1 (9.1%)	6 (50%)	13 (59.1%)
>37 weeks	10 (90.9%)	6 (50%)	9 (40.9%)
Intrapartum Complications			
Prolonged ROM (>18 hours)	4 (36.4)	4 (36.4)	4 (19.1)
Placental Abruptions	1 (9.1)	1 (9.1)	1 (4.8)
Premature Rupture of Membranes	0 (0)	0 (0)	1 (4.8)
Preterm Labor	1 (9.1)	6 (54.5)	5 (23.8)
Urinary Tract Infection	0 (0)	0 (0)	1 (4.8)
Endometritis	0 (0)	1 (9.1)	1 (4.8)
Intra-amniotic infection (chorioamnionitis)	7 (63.6)	3 (27.3)	7 (33.3)
Maternal Fever	4 (36.4)	4 (36.4)	8 (38.1)

(Contd.)

	GBS (N = 11)	E. COLI (N = 12)	OTHER PATHOGENS (N = 22)
Fetal distress (fetal tachycardia, non-reassuring fetal heart tones)	6 (54.5)	3 (27.3)	6 (28.6)
Chronic hypertension-PIH	1 (9.1)	2 (18.2)	3 (14.3)
Use of Maternal Steroids	3 (27.3)	5 (45.5)	9 (42.9)
Delivery Mode			
Vaginal	6 (54.5)	7 (63.6)	7 (33.3)
Cesarean section	5 (45.5)	4 (36.4)	14 (66.7)
Demographics			
Age (years)	30.18 ± 4.71	29.18 ± 8.30	31.75 ± 6.01
Ethnicity			
White	5 (45.5)	4 (36.4)	5 (23.8)
Black or AA	2 (18.2)	0 (0)	8 (38.1)
Hispanic or Latino	3 (27.3)	2 (18.2)	4 (19.1)
Asian	1 (9.1)	1 (9.1)	1 (4.8)
Other or Not available	0 (0)	4 (36.4)	3 (14.3)
Gravidity	1 (1–5)	2 (1–3)	1 (1–3)
Parity	1 (1–5)	1 (1–3)	1 (1–2)
HIV	0 (0)	0 (0)	0 (0)
Asthma	2 (18.2)	2 (18.2)	2 (9.5)
Diabetes or Gestational Diabetes	0 (0)	0 (0)	2 (9.5)
Obesity	1 (9.1)	1 (9.1)	6 (28.6)
Chronic Hypertension	1 (9.1)	2 (18.2)	3 (14.3)
Advanced Maternal Age	1 (9.1)	4 (36.4)	8 (38.1)
Psychiatric Disorder	1 (9.1)	1 (9.1)	0 (0)
Substance Abuse	0 (0)	0 (0)	1 (4.8)

COMPETING INTERESTS

The authors have no competing interests to declare.

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