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MATERNAL AND NEONATAL FACTORS IDENTIFIED AMONG NEONATES WITH CULTURE-CONFIRMED SEPSIS AT A TERTIARY CARE HOSPITAL IN KARACHI, PAKISTAN

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Abstract

Background: *Neonatal sepsis remains a major cause of neonatal morbidity and mortality worldwide, particularly in low- and middle-income countries. Despite advances in neonatal care, the burden of sepsis remains high due to the presence of preventable maternal and neonatal factors. Early identification of these factors may facilitate timely intervention and improve neonatal outcomes.*

Objective: *To determine the frequency of maternal and neonatal factors identified among neonates with culture-confirmed neonatal sepsis admitted to a tertiary care hospital.*

Methods: *This cross-sectional study was conducted in the Department of Pediatrics, Dr. Ruth K.M. Pfau Civil Hospital Karachi, Pakistan, from 9 November 2020 to 10 May 2021. A total of 214 neonates aged 0-28 days with culture-confirmed neonatal sepsis were enrolled through non-probability consecutive sampling. Data regarding maternal and neonatal characteristics were collected using a structured proforma. Maternal factors assessed included inadequate antenatal care, gestational hypertension, urinary tract infection, sexually transmitted infection, premature rupture of membranes, chorioamnionitis, endometritis, and Group B Streptococcus colonization. Neonatal factors included prematurity, low birth weight, low APGAR score at one minute, and resuscitation at birth. Data were analyzed using SPSS version 21. Descriptive statistics were used to summarize study variables.*

Results: *A total of 214 neonates with culture-confirmed neonatal sepsis were included. The mean maternal age was 26.65 ± 5.83 years, while the mean gestational age and birth weight of the neonates were 34.83 ± 3.78 weeks and 2419.6 ± 727.3 g, respectively. Male neonates accounted for 59.8% of cases. Among maternal factors, inadequate antenatal care was the most frequently*

observed factor (39.7%), followed by urinary tract infection (34.6%), gestational hypertension (25.2%), premature rupture of membranes (24.8%), sexually transmitted infection (14.5%), chorioamnionitis (9.8%), endometritis (9.3%), and Group B Streptococcus colonization (5.1%). Among neonatal factors, preterm birth was the most common finding (65.0%), followed by resuscitation at birth (62.6%), low birth weight (51.4%), and low APGAR score (50.0%). ***Conclusion:*** *Preterm birth, resuscitation at birth, low birth weight, and low APGAR score were the most frequently identified neonatal factors among neonates with culture-confirmed sepsis. Among maternal factors, inadequate antenatal care, urinary tract infection, gestational hypertension, and premature rupture of membranes were the most common findings. Strengthening antenatal care services and improving the identification and management of maternal and neonatal risk conditions may contribute to improved neonatal outcomes.*

INTRODUCTION

Neonatal sepsis remains a major global health challenge and is one of the leading causes of neonatal morbidity and mortality, particularly in low- and middle-income countries (LMICs). It is generally defined as a systemic infection occurring within the first 28 days of life and is most commonly confirmed by the isolation of a pathogenic microorganism from the bloodstream. Despite substantial advances in neonatal care, sepsis continues to contribute significantly to preventable neonatal deaths worldwide because of its nonspecific clinical presentation, rapid progression, and difficulties in early diagnosis [1-2].

The neonatal period represents the most vulnerable phase of life, accounting for nearly half of all deaths among children younger than five years of age. According to UNICEF estimates, approximately 2.3 million neonatal deaths occurred globally in 2024, with almost 47% of all under-five deaths occurring during the neonatal period. South Asia and sub-Saharan Africa continue to bear the highest burden of neonatal mortality [3]. Neonatal infections, including sepsis, pneumonia, and meningitis, are responsible for more than 550,000 neonatal deaths annually and remain among the leading causes of neonatal mortality worldwide [4]. Recent evidence also suggests that progress in reducing neonatal sepsis-related deaths has been slower than improvements achieved for many other neonatal conditions, particularly in resource-constrained settings [5].

Neonatal sepsis is commonly classified as early-onset sepsis (EOS) and late-onset sepsis (LOS). Early-onset sepsis usually presents within the first 72 hours of life and is predominantly associated with vertical transmission of microorganisms from the mother before or during delivery. Late-onset sepsis occurs after 72 hours of life and is more frequently associated with community-acquired or healthcare-associated infections [1,6]. This distinction is clinically important because the epidemiology, risk factors, causative organisms, and preventive strategies differ between the two presentations.

The etiology of neonatal sepsis varies across geographical regions and healthcare settings. In high-income countries, Group B Streptococcus (GBS) and Escherichia coli remain the predominant pathogens responsible for EOS, whereas Gram-negative organisms such as Klebsiella pneumoniae, Acinetobacter species, and E. coli are frequently reported in LMICs. The increasing prevalence of multidrug-resistant organisms further complicates treatment and contributes to poor neonatal outcomes [5-8].

Several maternal factors have been consistently identified as contributors to neonatal sepsis. Maternal urinary tract infections, sexually transmitted infections, prolonged rupture of membranes, chorioamnionitis, intrapartum fever, inadequate antenatal care, preterm labor, GBS colonization, and obstetric complications have all been associated with an increased risk of neonatal infection [6,9-10]. A recent meta-analysis of perinatal risk factors reported significant associations of premature rupture of membranes, maternal genitourinary infections, chorioamnionitis, maternal fever, and GBS colonization with early-onset neonatal sepsis [10].

Neonatal characteristics also play a critical role in the development of sepsis. Preterm birth, low birth weight, birth asphyxia, low Apgar scores, fetal distress, and the need for resuscitation at birth have been repeatedly associated with increased susceptibility to infection [1, 11-12]. Premature and low-birth-weight infants are particularly vulnerable because of their immature immune systems, impaired skin and mucosal barriers, and greater need for invasive medical interventions. A recent scoping review identified prematurity, low birth weight, low Apgar scores, maternal urinary infection, and GBS colonization among the most frequently reported determinants of neonatal sepsis worldwide [11].

Pakistan continues to face a substantial burden of neonatal mortality, and neonatal sepsis remains a common reason for admission to neonatal intensive care units. Recent studies from Pakistan have demonstrated that Gram-negative organisms, especially Klebsiella pneumoniae and Escherichia coli, account for a large proportion of culture-confirmed neonatal sepsis cases, with alarmingly high rates of antimicrobial resistance [13-14]. Furthermore, local studies have highlighted the importance of modifiable maternal and neonatal risk factors such as prematurity, low birth weight, prolonged rupture of membranes, and maternal infections in the development of neonatal sepsis [15].

Although numerous international studies have investigated determinants of neonatal sepsis, the distribution and relative contribution of maternal and neonatal risk factors vary across populations because of differences in socioeconomic conditions, healthcare access, infection control practices, and microbial epidemiology. Local evidence from Karachi remains limited, particularly regarding the frequency of maternal and neonatal factors among neonates with culture-confirmed sepsis. Identifying these factors in the local setting is essential for improving risk stratification, facilitating early diagnosis, guiding preventive strategies, and ultimately reducing neonatal morbidity and mortality.

Therefore, this study was designed to determine the frequency of maternal and neonatal factors responsible for neonatal sepsis in Karachi. The findings are expected to provide locally relevant evidence that may assist clinicians in early recognition of at-risk neonates and support the development of targeted preventive and management strategies.

Objective

To determine the frequency of maternal and neonatal factors responsible for neonatal sepsis.

Methods

Study Design

A hospital-based cross-sectional study was conducted to determine the frequency of maternal and neonatal factors associated with neonatal sepsis

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Study Setting

The study was conducted in the Department of Pediatrics, Civil Hospital Karachi, a tertiary care teaching hospital that receives referrals from Karachi and surrounding districts.

Study Duration

Data collection was carried out over a six-month period from 9 November 2020 to 10 May 2021.

Sample Size

The sample size was calculated using the WHO Sample Size Calculator by taking a prevalence of 3.6% for neonatal resuscitation at birth among neonates with sepsis based on a previous study. Using a 95% confidence level and an absolute precision of 2.5%, the required sample size was calculated to be 214 neonates.

Sampling Technique

Non-probability consecutive sampling was employed.

Study Population

The study population comprised neonates diagnosed with neonatal sepsis and admitted to the Department of Pediatrics, Civil Hospital Karachi during the study period.

Inclusion Criteria

- Neonates fulfilling all of the following criteria were enrolled:
- Male and female neonates.
- Age from birth to 28 completed days of life.
- Diagnosed cases of neonatal sepsis.
- Positive blood culture for a bacterial pathogen.
- Informed written consent obtained from parents or legal guardians.
- Maternal age between 22 and 45 years.
- Mothers with any gravidity and parity status.

Exclusion Criteria

- The following neonates were excluded:
- Neonates who expired on arrival.
- Neonates with incomplete medical records.
- Neonates with neural tube defects.
- Neonates with gross congenital anomalies.
- Neonates born to mothers who had received antibiotic therapy within two weeks prior to admission.

Data Collection Procedure

Prior approval was obtained from the Institutional Ethical Review Committee of Civil Hospital Karachi and the College of Physicians and Surgeons Pakistan (CPSP). Written informed consent was obtained from the parents or legal guardians before enrollment.

All eligible neonates admitted during the study period were assessed by the principal investigator within the first 24 hours of admission. Neonatal sepsis was confirmed through a positive blood culture. Data were collected using a structured and predesigned proforma.

The following neonatal variables were recorded:

- Age at admission (days)
- Gender
- Gestational age
- Birth weight
- Apgar score at one minute
- Requirement of resuscitation at birth
- Duration of hospital stay

The following maternal variables were recorded:

- Maternal age
- Gravidity
- Parity
- Mode of delivery
- Gestational hypertension
- Urinary tract infection (UTI)
- Sexually transmitted infection (STI)
- Premature rupture of membranes (PROM)
- Chorioamnionitis
- Endometritis
- Group B Streptococcus colonization
- Adequacy of antenatal care

All variables were assessed according to the predefined operational definitions. Information was obtained from maternal interviews, neonatal records, antenatal records, labor room documentation, laboratory reports, and hospital charts.
To minimize information bias, all data were collected by the principal investigator using standardized procedures. Selection bias was reduced by enrolling all consecutive eligible participants during the study period.

Data Analysis
Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 21.0.Quantitative variables, including maternal age, gestational age, birth weight, Apgar score at one minute, duration of hospitalization, and duration of rupture of membranes, were summarized as mean ± standard deviation (SD).
Qualitative variables, including neonatal gender, maternal educational status, mode of delivery, gravidity, parity, gestational hypertension, UTI, STI, PROM, Group B Streptococcus colonization, chorioamnionitis, endometritis, inadequate antenatal care, prematurity, low birth weight, low Apgar score (<7 at one minute), and resuscitation at birth, were presented as frequencies and percentages.
Stratification was performed for potential effect modifiers, including:
- Maternal age
- Maternal educational status
- Gravidity
- Parity
- Gestational age
- Mode of delivery
- Duration of hospital stay
- Duration of rupture of membranes
- Neonatal gender
- Birth weight

Post-stratification comparisons were performed using the Chi-square test. A p-value ≤0.05 was considered statistically significant.

Ethical Considerations
Ethical approval was obtained from the Institutional Review Board/Ethical Review Committee of Civil Hospital Karachi and the College of Physicians and Surgeons Pakistan (CPSP) before commencement of the study. Written informed consent was obtained from parents or legal guardians of all enrolled neonates. Confidentiality and anonymity of participants were maintained throughout the study, and data were used solely for research purposes.

RESULTS
A total of 214 neonates with culture-confirmed neonatal sepsis were included in this study. The demographic, obstetric, maternal, and neonatal characteristics of the study participants are presented in Tables 1-3 and Figures 1-2.

Baseline Characteristics of the Study Population
The mean maternal age was 26.65 ± 5.83 years and ranged from 20 to 40 years. The majority of mothers (65.4%, n=140) were aged ≤26 years, whereas 34.6% (n=74) were aged >26 years. This indicates that most neonates with sepsis were born to relatively young mothers.Among the 214 neonates, 128 (59.8%) were male and 86 (40.2%) were female, yielding a male-to-female ratio of approximately 1.5:1. This finding suggests a predominance of male neonates among culture-confirmed sepsis cases.
The mean gestational age was 34.83 ± 3.78 weeks, with values ranging from 28 to 39 weeks. More than half of the neonates (55.1%, n=118) were delivered before 37 completed weeks of gestation, while 44.9% (n=96) were born at term or beyond. The predominance of preterm deliveries indicates a substantial burden of prematurity among neonates diagnosed with sepsis.The mean birth weight was 2419.6 ± 727.3

g, ranging from 1000 g to 3400 g. Nearly half of the neonates (47.7%, n=102) weighed less than 2500 g at birth, whereas 52.3% (n=112) weighed 2500 g or more. The relatively low mean birth weight reflects the coexistence of prematurity and growth-related vulnerabilities within the study population.

Regarding maternal educational status, 85 (39.7%) mothers were illiterate, 107 (50.0%) had education up to matric level, and only 22 (10.3%) had attained education at intermediate level or above. Thus, almost nine out of ten mothers had either no formal education or education up to matriculation.With respect to delivery characteristics, 139 (65.0%) neonates were delivered by cesarean section, while 75 (35.0%) were delivered vaginally. Cesarean delivery was therefore the predominant mode of delivery among neonates diagnosed with sepsis. Assessment of gravidity revealed that 53 (24.8%) mothers were primigravida, 53 (24.8%) were multigravida, and 108 (50.5%) were grand multigravida. Similarly, parity status showed that 74 (34.6%) mothers were primiparous, 43 (20.1%) were multiparous, and 97 (45.3%) were grand multiparous. Grand multiparity and grand multigravidity therefore represented the largest obstetric groups in the study.

The mean duration of neonatal hospitalization was 13.02 ± 6.74 days, with a minimum stay of 5 days and a maximum stay of 28 days. Slightly more than half of the neonates (55.1%, n=118) stayed in hospital for 13 days or less, while 44.9% (n=96) required hospitalization for more than 13 days. Premature rupture of membranes (PROM) was observed in 53 (24.8%) mothers. Among these mothers, the mean duration of membrane rupture was 22.84 ± 4.09 hours, ranging from 18 to 28 hours. Detailed demographic and clinical characteristics are presented in Table 1.

Table 1: Socio-demographic, Maternal and Neonatal Characteristics of Study Participants (n=214)

Variable	Mean ± SD / n (%)
Maternal age (years)	26.65 ± 5.83
Maternal age ≤26 years	140 (65.4)
Maternal age >26 years	74 (34.6)
Male gender	128 (59.8)
Female gender	86 (40.2)
Gestational age (weeks)	34.83 ± 3.78
<37 weeks	118 (55.1)
≥37 weeks	96 (44.9)
Birth weight (g)	2419.6 ± 727.3
<2500 g	102 (47.7)
≥2500 g	112 (52.3)
Duration of stay (days)	13.02 ± 6.74
Cesarean delivery	139 (65.0)
Vaginal delivery	75 (35.0)
Primigravida	53 (24.8)
Multigravida	53 (24.8)
Grand multigravida	108 (50.5)
Primiparous	74 (34.6)
Multiparous	43 (20.1)
Grand multiparous	97 (45.3)
PROM present	53 (24.8)
Duration of PROM (hours)*	22.84 ± 4.09

*Among mothers with PROM (n=53).

Frequency of Maternal Factors Associated with Neonatal Sepsis

Among the maternal factors evaluated, inadequate antenatal care was the most frequently observed factor and was identified in 85 (39.7%) mothers. This was followed by urinary tract infection (UTI) in 74 (34.6%) mothers and gestational hypertension in 54 (25.2%) mothers.A history of premature rupture of

membranes (PROM) was documented in 53 (24.8%) cases. Sexually transmitted infections (STIs) were observed in 31 (14.5%) mothers. Less frequent maternal factors included chorioamnionitis in 21 (9.8%), endometritis in 20 (9.3%), and Group B Streptococcus (GBS) colonization in 11 (5.1%) mothers.Overall, maternal infectious conditions, including UTI, STI, chorioamnionitis, endometritis, and GBS colonization, accounted for a considerable proportion of maternal factors identified among neonates diagnosed with sepsis. The distribution of maternal factors is summarized in Table 2 and illustrated in Figure 1.

Table 2: Frequency of Maternal Factors Associated with Neonatal Sepsis (n=214)

Maternal Factor	n	%
Inadequate antenatal care	85	39.7
Urinary tract infection	74	34.6
Gestational hypertension	54	25.2
Premature rupture of membranes	53	24.8
Sexually transmitted infection	31	14.5
Chorioamnionitis	21	9.8
Endometritis	20	9.3
Group B Streptococcus colonization	11	5.1

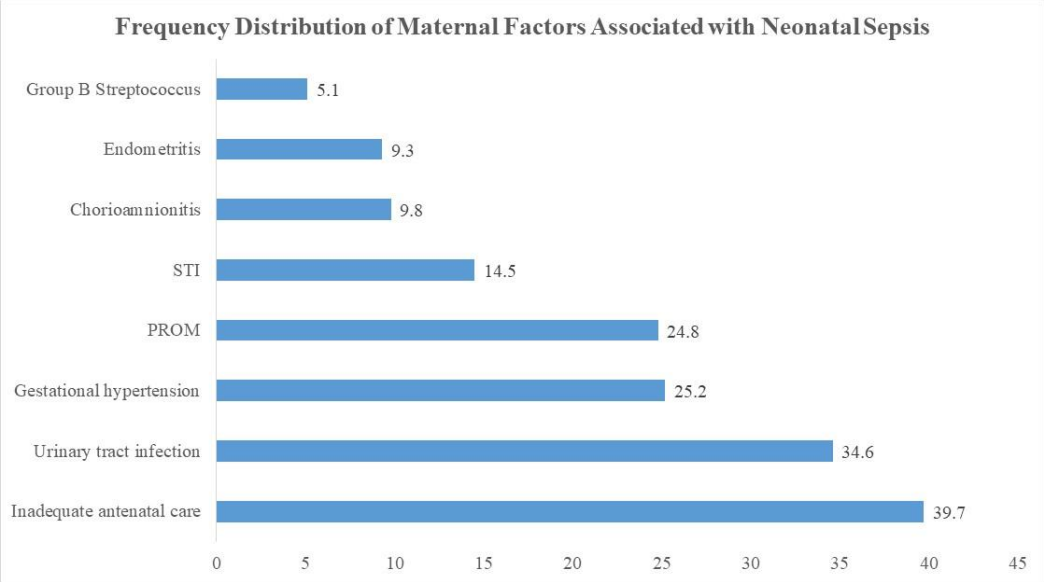


Figure 1: Frequency Distribution of Maternal Factors Associated with Neonatal Sepsis

Frequency of Neonatal Factors Associated with Neonatal Sepsis

The frequency distribution of maternal factors identified among neonates with culture-confirmed sepsis is presented in Table 2 and Figure 1.Among all maternal factors evaluated, inadequate antenatal care was the most frequently observed condition and was documented in 85 (39.7%) mothers. This indicates that nearly two out of five mothers had not received adequate antenatal care during pregnancy according to the predefined operational criteria.The second most common maternal factor was urinary tract infection (UTI), which was reported in 74 (34.6%) mothers. Thus, approximately one-third of mothers had evidence of urinary tract infection during pregnancy. Gestational hypertension was identified in 54 (25.2%) mothers, affecting approximately one-quarter of the study population.

A history of premature rupture of membranes (PROM) was noted in 53 (24.8%) mothers, making it one of the most frequently encountered obstetric factors. The prevalence of PROM was comparable to that of gestational hypertension.

Sexually transmitted infections (STIs) were present in 31 (14.5%) mothers. Although less common than inadequate antenatal care, UTI, hypertension, and PROM, STIs were still observed in approximately one out of every seven mothers.Less frequently reported maternal conditions included chorioamnionitis, which was documented in 21 (9.8%) mothers, and endometritis, reported in 20 (9.3%) mothers. Both conditions affected nearly one-tenth of the study population.

Group B Streptococcus (GBS) colonization had the lowest frequency among all maternal factors and was observed in only 11 (5.1%) mothers.When maternal factors were ranked according to frequency, the order was: inadequate antenatal care (39.7%), UTI (34.6%), hypertension (25.2%), PROM (24.8%), STI (14.5%), chorioamnionitis (9.8%), endometritis (9.3%), and GBS colonization (5.1%).Overall, maternal infectious and obstetric conditions constituted a substantial proportion of factors identified among neonates with culture-confirmed sepsis.

Frequency of Neonatal Factors Associated with Neonatal Sepsis

The frequency distribution of neonatal factors is shown in Table 3 and Figure 2.Among neonatal factors, preterm birth was the most frequently observed characteristic and was present in 139 (65.0%) neonates. Nearly two-thirds of septic neonates were born before 37 completed weeks of gestation.The second most common neonatal factor was the requirement for resuscitation at birth, which was documented in 134 (62.6%) neonates. This finding indicates that approximately three out of every five neonates required immediate intervention at delivery.

Table 3: Frequency of Neonatal Factors Associated with Neonatal Sepsis (n=214)

Neonatal Factor	n	%
Preterm birth	139	65
Resuscitation at birth	134	62.6
Low birth weight	110	51.4
Low APGAR score (<7 at 1 minute)	107	50

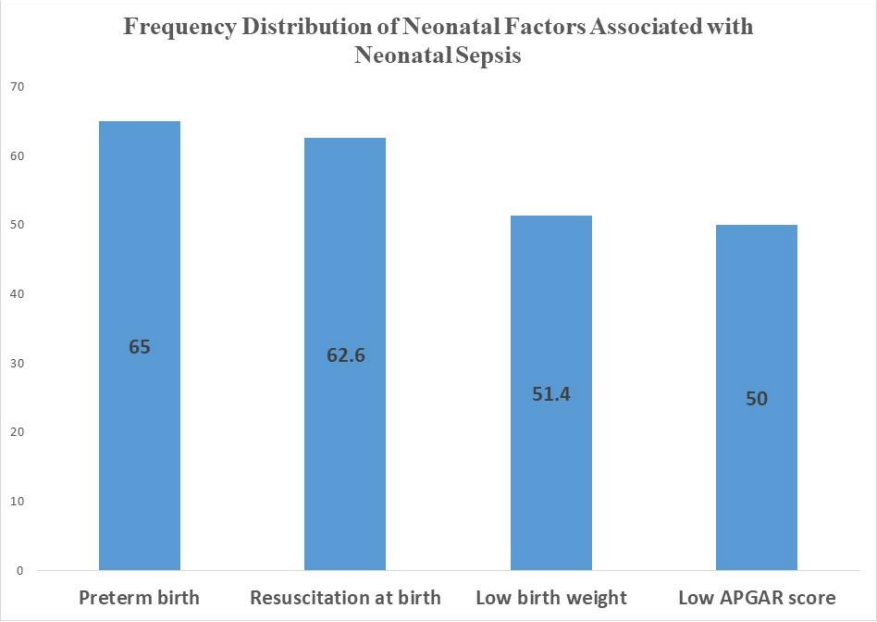


Figure 2: Frequency Distribution of Neonatal Factors Associated with Neonatal Sepsis

Low birth weight was observed in 110 (51.4%) neonates. Thus, more than half of the neonates with culture-confirmed sepsis weighed less than 2500 g at birth.Similarly, 107 (50.0%) neonates had a low APGAR score (<7 at one minute), indicating that half of the study population experienced some degree of perinatal compromise immediately after birth.A comparison of the identified neonatal factors demonstrated that preterm birth and resuscitation at birth were considerably more frequent than low

birth weight and low APGAR score. Nevertheless, all four factors were common and each affected approximately half or more of the neonates included in the study.
Overall, the findings suggest that prematurity, perinatal distress necessitating resuscitation, low birth weight, and low APGAR scores were prevalent characteristics among neonates diagnosed with sepsis in this tertiary care setting.

Summary of Major Findings
Among maternal factors, inadequate antenatal care (39.7%) was the most common finding, followed by urinary tract infection (34.6%), gestational hypertension (25.2%), and premature rupture of membranes (24.8%). Chorioamnionitis (9.8%), endometritis (9.3%), and Group B Streptococcus colonization (5.1%) were comparatively less common.
Among neonatal factors, preterm birth (65.0%) represented the most frequently observed characteristic, closely followed by resuscitation at birth (62.6%). Low birth weight (51.4%) and low APGAR score (50.0%) were also highly prevalent.
Collectively, these findings highlight the substantial contribution of adverse maternal conditions, inadequate prenatal care, prematurity, and perinatal compromise among neonates with culture-confirmed sepsis admitted to a tertiary care hospital.

Discussion
The present study was conducted to determine the frequency of maternal and neonatal factors identified among neonates with culture-confirmed neonatal sepsis admitted to a tertiary care hospital in Karachi. The findings demonstrated that inadequate antenatal care, urinary tract infection, gestational hypertension, and premature rupture of membranes were the most common maternal factors, whereas preterm birth, resuscitation at birth, low birth weight, and low APGAR score were the predominant neonatal factors.
In the present study, male neonates constituted 59.8% of all neonatal sepsis cases. Similar male predominance has been reported in previous studies conducted in Africa and Asia. Aku et al. reported that 58.4% of neonatal sepsis cases occurred among male infants, while Olorukooba et al. observed that males represented approximately 60% of septic neonates [16,17]. This observation is also consistent with the systematic review by Murthy et al., which identified male sex as a commonly reported characteristic among neonates with sepsis [12]. The biological basis for this finding has been attributed to sex-related immunological differences and the influence of X-linked immune regulatory genes that may increase susceptibility to infection among male newborns.
More than half of the neonates in our study were born before 37 weeks of gestation, and preterm birth emerged as the most frequent neonatal factor, affecting 65.0% of neonates. This finding is consistent with previous literature that identifies prematurity as one of the strongest determinants of neonatal sepsis. Murthy et al. reported in a systematic review and meta-analysis that preterm infants had a significantly increased risk of developing neonatal sepsis compared with term neonates [12]. Similarly, Gebremedhin et al. found prematurity to be among the strongest predictors of neonatal sepsis in Ethiopian hospitals [18]. Recent reviews also continue to recognize prematurity as one of the most important contributors to neonatal sepsis because of immature immune defenses, reduced transplacental antibody transfer, and increased exposure to invasive procedures during neonatal care [5].
Low birth weight was observed in 51.4% of septic neonates in the present study. This finding is comparable to reports from developing countries where low birth weight consistently remains a major contributor to neonatal infections. Murthy et al. found that low birth weight significantly increased the likelihood of neonatal sepsis across multiple countries [12]. Similarly, Hasan and Mahmood reported that low birth weight was one of the most frequent characteristics among neonates diagnosed with sepsis in Bangladesh [19]. The increased susceptibility of low-birth-weight infants is likely related to reduced physiological reserves, immaturity of innate immunity, and a higher frequency of neonatal complications requiring hospitalization.
A low APGAR score at one minute was identified in 50.0% of neonates included in this study. Similar findings have been reported by Siakwa et al., who observed that birth asphyxia and low APGAR scores

frequently coexisted with neonatal sepsis [20]. Perinatal compromise reflected by a low APGAR score may predispose neonates to infection by impairing immune function, compromising tissue perfusion, and increasing the need for invasive neonatal interventions.

Resuscitation at birth was required in 62.6% of neonates and represented the second most common neonatal factor identified in this study. A comparable finding was reported by Tewabe et al., who identified neonatal resuscitation as an important factor among septic neonates admitted to a referral hospital in Ethiopia [21]. Resuscitation often reflects underlying fetal distress and perinatal complications, both of which may increase neonatal vulnerability to infection. In addition, invasive resuscitation procedures may provide opportunities for exposure to pathogenic microorganisms if strict aseptic practices are not maintained.

Among maternal factors, inadequate antenatal care was the most common finding and was observed in 39.7% of mothers. This observation is consistent with previous studies that have highlighted the importance of antenatal care in reducing maternal infections and improving neonatal outcomes. Adatara et al. demonstrated that mothers with inadequate antenatal follow-up were more likely to have neonates developing sepsis [22]. Similarly, recent reviews have emphasized that effective antenatal care facilitates early diagnosis and management of maternal conditions that increase neonatal infection risk [5,10]. The relatively high proportion of inadequate antenatal care observed in our study may reflect barriers in accessing maternal healthcare services in low-resource settings.

Urinary tract infection was identified in 34.6% of mothers and represented the second most common maternal factor. This finding is consistent with observations by Adatara et al. and Endale et al., both of whom reported maternal urinary tract infection as a common factor among mothers of neonates with sepsis [11, 22]. Maternal urinary tract infections may contribute to ascending bacterial colonization, preterm labor, and neonatal infection through vertical transmission of microorganisms.

Gestational hypertension was present in approximately one-quarter of mothers. Although hypertension is not a direct infectious process, previous studies have shown that hypertensive disorders of pregnancy increase the risk of preterm delivery and low birth weight, both of which are strongly linked with neonatal sepsis [12, 23]. The frequency observed in our study may therefore be related to the substantial burden of prematurity and low birth weight within the study population.

Premature rupture of membranes was documented in 24.8% of mothers, with a mean duration of rupture exceeding 22 hours. This finding supports previous evidence identifying prolonged rupture of membranes as an important maternal factor in neonatal sepsis. Endale et al. reported that prolonged membrane rupture substantially increased the occurrence of adverse neonatal outcomes, including infection [11]. Likewise, recent neonatal sepsis reviews continue to recognize prolonged rupture of membranes as a key pathway for ascending bacterial invasion of the amniotic cavity and fetus [6].

Sexually transmitted infections were identified in 14.5% of mothers, while chorioamnionitis and endometritis were present in approximately one-tenth of cases. Maternal genital tract infections have repeatedly been implicated in neonatal infections because they facilitate exposure of the fetus and neonate to pathogenic microorganisms before or during childbirth [6, 13]. These findings reinforce the importance of screening and treating maternal infections as part of comprehensive antenatal care.

Group B Streptococcus colonization demonstrated the lowest frequency among maternal factors (5.1%). Similar low frequencies have been reported in several South Asian populations, contrasting with reports from high-income countries where Group B Streptococcus remains a leading cause of early-onset neonatal sepsis [6, 13]. Regional differences in maternal colonization rates, microbiological surveillance systems, and pathogen distribution may account for these variations. Recent evidence from Pakistan suggests that Gram-negative organisms such as Klebsiella species and Escherichia coli remain more prominent causes of neonatal sepsis than Group B Streptococcus [8, 15].

Overall, the findings of this study highlight the importance of both maternal and neonatal contributors to neonatal sepsis. Inadequate antenatal care, maternal infections, premature rupture of membranes, prematurity, low birth weight, low APGAR scores, and the need for resuscitation at birth were commonly identified among neonates with sepsis. Many of these factors are potentially preventable through improvements in antenatal healthcare, timely recognition and treatment of maternal infections, effective obstetric management, and enhanced neonatal monitoring. Strengthening these interventions may

contribute substantially to reducing the burden of neonatal sepsis in resource-limited settings such as Pakistan.

Conclusion

Neonatal sepsis was commonly identified among preterm and low-birth-weight neonates admitted to the Department of Pediatrics, Civil Hospital Karachi. Among neonatal factors, preterm birth, resuscitation at birth, low birth weight, and low APGAR score were the most frequently observed characteristics. Among maternal factors, inadequate antenatal care, urinary tract infection, gestational hypertension, and premature rupture of membranes were the most frequently identified conditions.

The findings highlight the importance of strengthening antenatal care services, improving the early detection and management of maternal infections and pregnancy-related complications, and ensuring close monitoring of high-risk neonates. Early recognition of these maternal and neonatal factors may facilitate timely intervention and contribute to improved neonatal outcomes.

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