



## OBSERVATIONAL DESCRIPTIVE STUDY

# Perinatal Risk Factors and Early Onset of Neonatal Sepsis

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### Abstract

**Background:** Neonatal sepsis contributes significantly to neonatal morbidity and mortality and is an ongoing major global public health challenge particularly in developing countries.

**Objective:** The study aims to determine the prevalence of early neonatal infections and risk factors associated with neonatal intensive care.

**Methods:** In a cross-sectional study that included all newborns admitted to the neonatal intensive care of Tishreen University Hospital from October 2019 for one year and who fulfilled clinical and laboratory criteria for early neonatal sepsis, blood samples were drawn for laboratory analysis (CBC, CRP) with a blood culture.

**Results:** 197 neonates (28.14%) had early neonatal sepsis. The majority of patients (80.71%) had negative blood cultures. The most common pathogen of the early neonatal infection was *Staphylococcus albicans*, *Streptococci*, and *E. coli*. The current study found that the most prevalent risk factor for early neonatal infection was a cesarean section, followed by maternal infections, male newborn sex, low birth weight, prematurity, maternal age greater than 30 years and less than 20 years, early rupture of membranes, need for resuscitation, and Meconium amino fluid.

**Conclusion:** The current study confirmed an important prevalence of early neonatal sepsis in Tishreen University Hospital with its association with many risk factors; the most prevalent factors were cesarean section, the gender of the male newborn, low birth weight, and prematurity.

### Keywords

Early neonatal sepsis, Risk factors, Cesarean delivery, Maternal sepsis

toxins, or their antigens into the blood circulation during the first 72 hours of life [1]. The diagnosis is made clinically by non-specific manifestations (low or high temperature of the newborn, lethargy, irritability, tachypnea or episodes of apnea, rapid or weak pulse, hypotension, low or high blood sugar, metabolic acidosis) [2].

In developing countries, the incidence of neonatal septicemia is 1.6% of all live births [3]. Early and late neonatal septicemia is the most common problem in the newborn stage that caused high morbidity and mortality rate. It is responsible for (30-50)% of neonatal deaths in developing countries, according to WHO estimates [4].

The pathogens that cause early neonatal sepsis are transmitted through the placenta, during childbirth, or after childbirth [5]. It may be bacterial, viral, or fungal. *Streptococcus* (group B) is the most common pathogen that causes early neonatal sepsis (50%), followed by *E. coli* (30%), then *Listeria*, *Haemophilus influenza*, *Enterococci*, *Staphylococci*, and *Pneumococci* [6].

There are many risk factors for early neonatal sepsis as maternal factors (urinary and genital infections, prenatal fever, prenatal laboratory septicemia, multiple pregnancies, frequent vaginal examinations, premature rupture of membranes more than 18 hours), neonatal factors (prematurity, low birth weight, perinatal asphyxia, low Apgar scores, intrauterine infection), environmental factors (use of resuscitation tools, medical and nursing staff) [7]. White blood cells (WBC), neutrophil count, C-reactive protein (CRP), and platelet count (PLT) are the laboratory criteria for early neonatal sepsis. Blood culture is the gold standard in diagnosis [8].

## Background

Early neonatal septicemia is a clinical laboratory syndrome caused by the passage of pathogens, their

Despite the great development and progress in neonatal treatment, high mortality rates (30-50%) are still a concern in developing countries compared to developed countries.

No local study has determined the prevalence of risk factors for early neonatal sepsis in Syria, so we conducted this research to find the most common risk factors for sepsis.

## Material and Methods

The current study was reviewed and approved by the ethical committee of Tishreen University Hospital. Informed consent was obtained from the patient's parents.

An observational descriptive study included 197 neonates who were referred to neonatal intensive care at Tishreen University Hospital in Lattakia over 1 year between October 2019 to November 2020.

On admission, detailed information was recorded on the research form (age, sex, gestational age, birth weight, age at admission, type of delivery, type of pregnancy, use of assistive devices, premature rupture of membranes, maternal age, urinary and genital infections in the mother, laboratory evaluation of the mother, amniotic fluid, obstetric Apgar, need for postpartum resuscitation, presence of congenital anomalies) with a full clinical examination of the patients included in the study. WBC, CRP, PLT with a blood culture procedure were performed in the laboratory of Tishreen University Hospital.

## Statistical methods

All data were analyzed using Statistical Package for social sciences (SPSS version 20). Descriptive statistical parameters (mean and standard deviation, frequencies, and percentage) were calculated for each quantitative variable. The prevalence rate was calculated.

## Results

The current study included 197 (28.14%) of the neonates of 700 neonates who were referred to the neonatal intensive care at Tishreen University Hospital in Lattakia.

The blood culture was negative (80.71%) in the majority of patients; staphylococcal infection (34.21%), followed by *streptococci* (31.58%), *E. coli* (18.42%), and *staphylococcus aureus* (15.79%). The majority of patients in the current study (80.20%) were diagnosed with sepsis at an age less than 24 hours as shown in [Table 1](#).

Most of the patients were males (65.5%) with a statistically significant difference between the studied groups according to the age ( $p$ -value = 0.004) with Sex Ratio (F:M) = 1.9:1. Prematurity and low birth weight were 50.76%, 55.84% respectively in the early neonatal sepsis ([Table 1](#)).

24 patients (12.18%) had congenital malformation; gastrointestinal malformations were the majority (58.33%) (diaphragmatic atresia 1 patient, esophageal atresia 3 patients, intestinal atresia 1 patient, anal atresia 8 patients, Hirschsprung 1 patient), cardiac malformations were (20.83%) (patent ductus arteriosus 1 patient, multiple cardiac malformation 1 patient, ventricular aplasia 1 patient, foramen ovale 1 patient, common stump arterial 1 patient), neurologic malformations 12.44% (Hydrocephalus 2 patient, meningocele 1 patient), urological malformation 4.2% (Bladder inversion 1 patient), extra fingers 1 patient.

The majority of the age of the mothers of the current study was more than 30-years-old (49.24%). Most of the patients' mothers 68.02% suffered from prenatal infections (respiratory 30.46%, urinary 35.53%, gastrointestinal 2.03%). Most of the patients had sterilized amniotic fluid 86.29% ([Table 2](#)).

**Table 1:** The neonatal risk factors of the early onset of neonatal sepsis.

	The risk factor	The number	Percentage
Age	Less than 24 hour	158	80.20%
	[24-48] hour	15	7.6%
	[48-72] hour	24	12.2%
Sex	male	129	65.5%
	female	68	34.5%
Gestational Age	More than 37 GA	97	49.24%
	[34-37] GA	57	28.93%
	[28-34] GA	39	19.8%
	Less than 28 GA	4	2.03%
Birth weight	[1500-2500] g	66	33.5%
	Less than 1500 g	44	22.34%
	More than 2500 g	87	44.16%
Malformations	Yes	24	12.18%
	No	173	87.82%

**Table 2:** The mother risk factors of the early onset of neonatal sepsis.

The risk factor		The number	Percentage	
Mother age	Less than 20 yr	20	10.15%	
	[24-30] yr	80	40.61%	
	More than 30 yr	97	49.24%	
Mother infections	Yes	134	68.02%	
	No	63	31.98%	
Meconium-stained amniotic fluid	No	170	86.29%	
	Yes	27	13.71%	
Premature rupture of membranes	Yes	Less than 18 h	25	12.69%
		More than 18 h	61	30.96%
	No	111	56.35%	
Delivery mode	Caesarean	168	85.28%	
	Vaginal	29	14.72%	

The majority of patients (56.35%) of the mothers did not have premature rupture of membranes, while 30.96% of the mothers had premature rupture of membranes more than 18 hours. Cesarean section was the most common type of delivery (85.28%) (Table 2).

135 neonates (68.53%) from the study sample did not require any resuscitation procedure, while 62 patients required resuscitation (31.47%) [49 patients received Ambuventilation only (24.87%), 13 patients were intubated with Ambuventilation (6.60%)].

## Discussion

The current study included 197 neonates (28.41%) who were referred to neonatal intensive care at Tishreen University Hospital in Lattakia.

In the current study, the majority of blood cultures were negative (80%), this may be that mothers in the majority of the sample had received prenatal preventive antibiotics in addition to the randomized use of antibiotics in our society. This is consistent with the results of many international studies in which positive blood cultures were recorded in only 30% of newborns with early septicemia [9].

In 2019, Abdul Rahman's study in Saudi Arabia on 245 newborns conducted that the largest cause of early newborn sepsis was *Streptococcus* (33.31%), followed by *E. coli* (27.31%). This is consistent with the Giannoni study [10,11]. In contrast to our study, which found the majority of blood cultures were *S. albicans* infection (34.21%) followed by *Streptococcus* (31.59%), and *E. coli* (18.42%) this may be that the majority of patients were premature infants with the presence of intravenous catheters or it may be contamination when the sample is taken for culture or during blood culture.

The Cesarean section was (85.28%) in the current study. This percentage is very high compared with zelalem study in Ethiopia in 2019, and the Asia Jabiri study in Dar AL Salaam Tanzania in 2015. This may be

attributed to a large number of cesarean sections without a real indication, due to the mothers' desire for rapid delivery, in addition to the lack of awareness of the risks related to this procedure [12,13].

Maternal infection was (68.02%) which is much higher than Giannoni's study in Switzerland (8%) and Zelalem study in Ethiopia in 2019 (16.7%) [10,13]. This discrepancy may be due to the different maternal health care systems applied in each country, as well as the economic, social and cultural factors in each country.

The percentage of the male sex as a risk factor for early neonatal sepsis was (65.5%), while in both the Gianoni and Getabelew studies in Ethiopia it was 52% and 58.1%, respectively, where the male sex is associated with 3.7 times higher risk of early neonatal sepsis than the feminine sex, the mechanism is not fully defined and is not clear. It is likely to be multifactorial with genetic, immunological, and hormonal influences. There are related factors such as genes linked to the X chromosome in the female immune system [10,13,14].

Low birth weight and preterm birth accounted for 55.84% and 50.76%, respectively, of the study sample, which is similar to the Mate Siakwa studies in Ghana and Giannini in Switzerland. Birth weights are most likely to receive intravenous fluids and medications, as well as a lack of IgG immunoglobulins in premature infants, are transmitted to the fetus from the mother through the placenta primarily during the third trimester of pregnancy [10,15,16].

Maternal age (above 30 years) and (less than 20 years) is considered a risk factor for early neonatal sepsis. The percentage of mothers over 30 years of age was the majority of patients with early neonatal sepsis (49.50%) and this is close to most international studies such as the Ethiopian study in 2019 and Dar's study Salam, who confirmed that newborns of mothers over 30 years of age are more prone to early neonatal sepsis [10,12].

Hassan's study in Bangladesh showed that the incidence of early neonatal sepsis increases in the newborns of mothers less than 20 years of age (67%) compared to our study, where it found that the rate is 10.15%. This could be due to the difference in the sample size and the social situation in Bangladesh, which dictates that females marry at an early age [8,11].

Maternal age less than 20 years is associated with a higher colonization rate of the vaginal wall with GBS(Group B *Streptococcus*), which explains the higher possibility of early neonatal sepsis, while age greater than 35 years is associated with the occurrence of serious medical complications associated with pregnancy such as gestational hypertension, diabetes, cardiovascular disease, congenital malformations and chromosomal problems, multiple pregnancies, prematurity, low birth weight and the need for cesarean section [3,11].

The number of newborns diagnosed with early sepsis with premature rupture of membranes was about 43.65%, which is close to what was found in the study of Asia Jabiri in Tanzania (49.5%), whereby premature rupture of membranes may increase the risk of fetal exposure to pathogens in an ascending way [12].

The percentage of neonates who required resuscitation with early neonatal sepsis was (31.47%), which is close to the percentage found by the Asia Jabiri study in Tanzania (37.7%) [12].

Resuscitation at birth was also associated with the development of early sepsis in both the Mate Siakwa studies in Ghana and Getabelw in Ethiopia, as resuscitation using non-sterile equipment increases the likelihood of introducing pathogens into the lungs of a fetus whose immune system is not yet well developed [14,15].

Both the Getabelw studies in Ethiopia and Saleh in Lattakia confirmed that meconium-stained amniotic fluid is a risk factor for early neonatal sepsis, 7%, and 10%, respectively. The same result was found in our study where the percentage reached (13.71%) as sepsis is considered among the factors of fetal distress that often lead to a condition of meconium-stained amniotic fluid [11,14-17].

## Conclusion

The current study showed an important prevalence of early neonatal sepsis in newborns admitted to neonatal intensive care at Tishreen University Hospital. It is associated with many risk factors such as cesarean section, prematurity, low birth weight in addition to the male gender.

## Data Availability

We can't share patient data due to our hospital's privacy policy, which is concerned with maintaining patient confidentiality and refuses to publish or share

data. Also, the informed consent signed by the parents to participate in the study prevents the sharing of information with the non-Study researchers.

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## Statement of Ethics

All parents whose children were studied gave informed consent for sharing of this research. Ethical clearance for this study was obtained from the Ethical Committee of the University of Tishreen Hospital.

## Funding Sources

None.

## Conflict of Interest Statement

None declared.

## Author Contributions

Both authors developed and carried out sample collection. Literature review, the data analysis and read through the final data were done by both authors.

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