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Risk Factors for Neonatal Sepsis in Sulaimania Pediatrics Teaching Hospital

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Abstract: A prospective case-control study was performed to determine the maternal and neonatal risk factors for Septicemia in neonates aged (≤28) days admitted to the neonatal care unit in Sulaimania Pediatrics Teaching Hospital over a period of ten months from 1st of March 2021 to 31st of December 2022. One hundred ten cases with neonatal sepsis diagnosed by positive blood culture and 110 control culture-negative cases selected were studied; early onset neonatal sepsis (EONS) (≤ 7 days age) forms 41.8%, while late-onset neonatal sepsis (LONS) (from 8-28days age) forms 58.2%. Our study shows there is an association between age at presentation, gender, weight, gestational age, maternal diseases, early rupture membrane (EROM), previous admission, and increased risk of development of neonatal sepsis. 62.7% percent of studies were male, 56.3% were premature, gram-positive bacteria were the predominant isolates both in early-onset neonatal sepsis and late-onset neonatal sepsis, Staphyloccocus aeurus was the commonest organisms detected; it forms (16.4%). Out of 110 cases, the mortality rate was 18.9% (55%) in late-onset neonatal sepsis and (45%) in early-onset neonatal sepsis. As conclusion, a gram-positive bacterium (specially Staphylococcus aeurus) was the leading bacterial agent of neonatal sepsis in our environment, and the relative high frequency of nosocomial infection mandates the intensification of preventive control measures to limit the spread of infection.

Keywords: Neonatal sepsis; IgG; Low birth weight; and Febrile illness.

INTRODUCTION

Neonatal sepsis is a clinical syndrome characterized by systemic signs of infection accompanied by bacteremia and occurring in the first month of life. The incidence of serious neonatal sepsis is variable [Seale, A.C. *et al*., 2014-Simonsen, K.A. *et al*., 2014]. Rates between 0.22 % and 11.2 % have been reported from the developed world, with mortality rates between 9-15%. From the developing world, rates of 10-30% are reported, with mortality between 30 - 45%. While other reports show that neonatal sepsis occurs in 1-21 infants per 1000 live births with a mortality rate as high as 30-69% of affected infants, developing countries have both the highest incidence and the highest mortality rates [Bizzarro, M.J. *et al*., 2005-Weston, E.J. *et al*., 2011]. A number of agents may infect newborns in the uterus, intrapartum, or postpartum. Intrauterine transplacental infections of significance to the fetus and/or newborn include rubella, cytomegalovirus (CMV), toxoplasmosis, parvovirus B19, and varicella. Although herpes simplex virus (HSV), human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and tuberculosis (TB) can each result in transplacental infection, the most common mode of transmission for these agents is intrapartum during labor and delivery with passage through an infected birth canal (HIV, HSV, HBV) or Postnatal from contact with an infected mother or caretaker (TB) [Stoll, B.J. *et al*., 2011-Polin, R.A, 2012]. Any micro inhabiting the maternal genitourinary or lower gastrointestinal tract may cause intrapartum and postpartum infection. Neonatal sepsis may be categorized as early or late onset. 85% of newborns with early-onset infection present within 24 hours, 5% present at 24-48 hours, and a smaller percentage of patients present between 48 hours and six days of life. Onset is most rapid in premature neonates. Early-onset sepsis syndrome is associated with the acquisition of microorganisms from the mother.

Transplacental infection or an ascending infection from the cervix may be caused by organisms that colonize in the mother's genitourinary tract, with the acquisition of the microbe by passage through a colonized birth canal at delivery [Visser, V.E. *et al*., 1979-Manroe, B.L. *et al*., 1979]. The microorganisms most commonly associated with early-onset infection include group B streptococcus (GBS), Escherichia coli, Haemophilus influenza, and Listeria monocytogenes. The fetal immune system develops in a sterile and protected environment and, therefore, lacks antigenic experience. It must also be modulated in order to co-exist with the mother's immune system. Soon after birth, the newborn is exposed to the "hostile world" of bacteria, viruses, fungi, and parasites and must

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immediately defend itself. The immunologic competence of the neonate progresses rapidly in the first three months of life as the cells involved in acquired immunity mature and gain antigenic experience. During this period, the neonate also depends upon components of the innate or antigen-independent immune system, including phagocytes, natural killer cells, antigen-presenting cells, humoral mediators of inflammation, and complement [Lloyd, B.W. *et al*., 1989-Gabay, C. *et al*., 1999].

PATIENTS AND METHODS

This is a prospective case/control study conducted on neonates (<28 days). One hundred ten blood culture-positive cases and 110 control cases who were healthy infants with no signs and symptoms of sepsis were studied.

The data was collected from the neonatal ward for ten month period from 1st of March 2021 to 31st of December 2022 in Sulaimania Pediatrics Teaching Hospital.

The relevant prenatal data adopted in this study were age at presentation, gender, weight, gestational age, mode of delivery, maternal fever, prolonged rupture membrane, meconium aspiration, and prior admission to the hospital.

Neonates were classified into two groups according to the age of onset of symptoms: the early onset (EONS), when the symptoms of sepsis started within the first seven days of life, which comprised (46) patients, and the late onset sepsis (LONS) when the symptom occurs after seven days of life till 28 days of life which comprised (64) patients.

The commonest causative microorganism was Staphylococcus aureus, as shown in Table (1). Statistical analysis was performed by SPSS 16.0. Odd ratio was used for the estimation of relative risk. P values <0.05 were regarded as significant.

RESULTS

Table 1: Causative microorganisms for neonatal sepsis, according to positive blood culture

Gram-positive	**Frequency**	**Percent**
Staph. aureus	36	16.4
GBS	16	7.3
Srep. viridance	2	0.9
Strep. fecalis	2	0.9
Strep. pneumone	1	0.5
Strep. pyogenes	1	0.5
Gram-negative	***Frequency***	***Percent***
E. coli	20	8.6
E. aerogenes	15	7.3
S. typhi	7	3.2
Pseudomonus	5	4.1
Klebsiella	3	1.4
Proteus	2	0.9
Total	**110**	**100%**

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Table 2: Characteristics of Cases and Controls

Variables	Case No. (%)	Control No (%)
Age at presentation		
Early (≤7days)	46 (41.8)	75 (68.2)
Late (>7days)	64 (58.2)	35 (31.8)
Gender		
Male	69 (62.73)	47 (42.73)
Female	41 (37.27)	63 (57.27)
Weight (Gm)		
>2500gm	47 (42.73)	10 (9.1)
≥ 2500gm	63 (57.27)	100 (90.9)
Gestational age (Weeks)		
Preterm (<37wk.s)	62 (56.36)	16 (14.55)
Full-term (≥37wk.s)	48 (43.64)	94 (85.45)
Mode of delivery		
C/S	56 (50.9)	65 (59.1)
NVD	54 (49.1)	45 (40.9)
Maternal fever (last week of pregnancy)		
Positive	41 (37.27)	11 (10)
Negative	69 (62.73)	99 (90)
prolonged rupture of membrane (>24 hours)		
Positive	28 (25.5)	10 (9.1)
Negative	82 (74.5)	100 (90.9)
Prior admission to hospital		
Positive	42 (38.2)	16 (14.5)
Negative	68 (61.8)	94 (85.5)
Meconium aspiration		
Positive	5 (4.5)	1 (0.9)
Negative	105 (95.5)	109 (99.1)

Table 3: Relative risk of neonatal sepsis with the gestational age

Association between variables and status (case and control)			Odds Ratio	95% Confidence Interval		P-value
				Lower	Upper	
Gestational age (Weeks)	Case (N)	Control (N)				
Preterm (<37wk.s)	62	16	2.351	1.820	3.036	
Full-term & post-term (≥37wk.s)	48	94	0.310	0.197	0.487	0.000

Neonatal sepsis was significantly associated with prematurity (p value=0.000), odd ratio 2.35 (95% C.I. 1.8 to 3.03). as shown in (Table-3).

Table 4: Relative risk of neonatal sepsis with weight

Association between variables and status (case and control)			Odds Ratio	95% Confidence Interval		P-value
				Lower	Upper	
Weight (Gm)	**Case (N)**	**Control (N)**				
<2500gm	47	10				
≥2500gm	63	100	2.13 .286	1.69 .161	2.67 .509	0.000

The risk for neonatal sepsis who weighing < 2500gm was (OR 2.3, 95% CI 1.34 to 4.12) & the P value (0.000) was highly significant, as shown in (Table-4)

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Table 5: Relative risk of gender with neonatal sepsis

Association between variables and status (case and control)				Odds Ratio	95% Confidence Interval		P-value
					Lower	Upper	
Gender		**Case (N)**	**Control (N)**				
male		47	**69**	1.509	1.13	2.00	0.002
Female	41		63	.669	.511	.875	

Although gender was a minor risk factor, but it was highly significant with the male gender, with a P-value (0.002), Odd ratio of 2.351, (95% C.I. 1.820 to 3.036), as shown in Table (5).

Table 6: Association between neonatal sepsis& age at diagnosis

Association between variables and status (case and control)			Odds Ratio	95% Confidence Interval		P-value
				Lower	Upper	
Age at presentation	Case (N)	Control (N)				
≤7days	46	75	.588	.449	.770	0.000
>7days	64	35	1.75	1.298	2.388	

Those with late presentation are at more risk (OR 1.75, 95% CI 1.298 to 2.388) for developing neonatal sepsis& the P value (0.000) was highly significant, as shown in Table-6.

Table 7: Relative risk of early rupture membrane

Association between variables and status (case and control)				Odds Ratio	95% Confidence Interval		P-value
					Lower	**Upper**	
PROM (> 24 hours)	case-control	Positive	28				
	10						
negative	82	100		1.635	1.275	2.097	0.001
				.479	.277	.829	

Neonatal sepsis was significantly associated with early rupture of membrane (>24 hours), P-value (0.001), Odd ratio 1.63, (95% C.I. 1.275 to 2.097). as shown in Table-7.

Table 8: Relative risk of previous admission& neonatal sepsis

Association between variables and status (case and control)			Odds Ratio	95% Confidence Interval		P-value
				Lower	Upper	
Prior admission to the hospital						
Case (N) Control (N)						
Positive	42	16	1.725	1.356	2.195	0.000
Negative	68	94	.475	.307	.736	

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Table 9: Relative risk between maternal diseases& neonatal sepsis

Association between variables a status (case and control)		d	Odds Ratio	95% Confidence Interval		P-value
				Lower	Upper	
Maternal fever & UTI	case	control				
Negative	69	99	.359	.209	.616	0.000
positive	41	11	1.92	1.53	2.415	

Table 10: Association between neonatal sepsis& type of delivery

Association between variables and status (case and control)			Odds Ratio	95% Confidence Interval		P-value
				Lower	Upper	
Type of delivery C a s e (N)		Control (N)				
C/S	54	45	1.182	.90	1.551	0.139
NVD	56	65	.848	.652	1.104	

Table 11: Association between neonatal sepsis & meconium aspiration

Association between variables and status (case and control)			Odds Ratio	95% Confidence Interval		P-value
				Lower	Upper	
Meconium aspiration	case	control				
Yes	5	1	1.698	1.158	2.491	0.106
No	105	109	.327	.543	1.968	

Table 12: Case fatality rate in early and late neonatal sepsis among 110 cases

Cases	EONS N (%)	LONS N (%)	Total
Cases	46 (41.81%)	64 (58.19%)	110 (100%)
Death	9 (45%)	11 (55%)	20 (100%)

DISCUSSION

Neonatal sepsis remains an important cause of mortality & morbidity in this age group despite the progress in hygiene, new effective antimicrobial agents & advances in early diagnosis and treatment. The study had showed that neonatal sepsis occurs more frequently among premature neonates. This result agrees with the studies of other workers, which suggest that prematurity is an important predisposing for factor sepsis. In the neonate, a possible explanation for this result is that premature infants lack well developed immune system or them prolong hospitalization, which increases the risk of nosocomial infection. LBW neonates were considered high risk for neonatal sepsis. This study is similar to the study of other workers [Cortese, F. *et al*., 2016].

The present study indicates that males are more affected than female neonates; this result is compatible with the data reported by other workers. Such results suggest the possibility of sex-linked factors in host susceptibility. The study revealed that late presentation was a major risk factor for neonatal sepsis; this is compatible with the study done in Kirkuk. This may be related to the character of our patients since most cases are either referred from the district hospital or presented after a period of hospitalization as a nosocomial infection, which is mostly manifested after (8th) day of life. [Sullins, A.K. *et al*., 2013]

Maternal factors like premature rupture of the membrane significantly increase the risk of infection; this result is comparable to the study of other workers. By 24 hours of membrane rupture, the incidence of early–onset disease with group B streptococcus (GBS) increases significantly; longer than 18 hr is an appropriate cut-off for an increased risk of neonatal infection. Greater than 24 hours, microscopic evidence of inflammation of membranes is uniformly present. This study showed a strong relationship between the history of previous hospitalization and the development of neonatal sepsis as a result of nosocomial infection. The infant's skin, respiratory tract, conjunctivae, and gastrointestinal tract umbilicus may be colonized from the environment, leading to the

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possibility of late–onset sepsis from an invasive microorganism.

This study showed a significant relation between maternal illness during the last weeks of the third trimester, such as maternal UTI and fever, and the development of neonatal sepsis. This study is in agreement with the studies done in Baghdad, Nepal, and Indonesia. Transplacental infection or an ascending infection from the cervix may be caused by organisms that colonize in the mother's genitourinary tract, with the acquisition of the microbe by passage through a colonized birth canal at delivery. Our study showed no significant relation between babies born by C/S and the development of neonatal sepsis. This result is incompatible with that done in Indonesia, which showed that Cesarean section (C/S) is a risk factor of developing neonatal sepsis. Meconium aspiration syndrome and development of neonatal sepsis, although the p-value was not significant, the odd ratio was (1.69), which it means there is some risk of developing sepsis among those infants with meconium aspiration syndrome; this result is in agreement with that done in Indonesia [Shane, A.L. *et al*., 2017]. Possible explanation for that is. However, meconium is sterile when aspirated into the lung; it may stimulate the release of cytokines and other vasoactive substances that lead to cardiovascular and inflammatory responses in the fetus and newborn. Meconium aspiration includes airway obstruction, chemical irritation, infection, and surfactant inactivation. However, it is likely that most cases of severe MAS are related in intrauterine pathologic processes, primarily asphyxia, and infection, rather than the aspiration of meconium by itself.

CONCLUSION

Early rupture of membrane, maternal fever and UTI, Gender, LBW, late presentations, history of previous admission, and invasive procedure are significant risk factors for the development of neonatal sepsis.

REFERENCES

1. Seale, A.C., Blencowe, H., Manu, A.A., Nair, H., Bahl, R., Qazi, S.A., Zaidi, A.K., Berkley, J.A., Cousens, S.N. and Lawn, J.E. "Estimates of possible severe bacterial infection in neonates in sub-Saharan Africa, south Asia, and Latin America for 2012: a systematic review and meta-analysis." *The Lancet infectious diseases* 14.8 (2014): 731-741.
2. Wynn, J.L. "Defining neonatal sepsis." *Curr Opin Pediatr*. 28.2(2016):135-40.
3. Simonsen, K.A., Anderson-Berry, A.L., Delair, S.F. and Davies, H.D. "Early-onset neonatal sepsis." *Clinical microbiology reviews* 27.1 (2014): 21-47.
4. Bizzarro, M.J., Raskind, C., Baltimore, R.S. and Gallagher, P.G. "Seventy-five years of neonatal sepsis at Yale: 1928–2003." *Pediatrics* 116.3 (2005): 595-602.
5. Van Dyke, M.K., Phares, C.R., Lynfield, R., Thomas, A.R., Arnold, K.E., Craig, A.S., Mohle-Boetani, J., Gershman, K., Schaffner, W., Petit, S. and Zansky, S.M. "Evaluation of universal antenatal screening for group B streptococcus." *New England Journal of Medicine* 360.25 (2009): 2626-2636.
6. Shane, A.L. and Stoll, B.J. "Recent developments and current issues in the epidemiology, diagnosis, and management of bacterial and fungal neonatal sepsis." *American journal of perinatology* 30.02 (2013): 131-142.
7. Weston, E.J., Pondo, T., Lewis, M.M., Martell-Cleary, P., Morin, C., Jewell, B., Daily, P., Apostol, M., Petit, S., Farley, M. and Lynfield, R. "The burden of invasive early-onset neonatal sepsis in the United States, 2005–2008." *The Pediatric infectious disease journal* 30.11 (2011): 937-41.
8. Stoll, B.J., Hansen, N.I., Sánchez, P.J., Faix, R.G., Poindexter, B.B., Van Meurs, K.P., Bizzarro, M.J., Goldberg, R.N., Frantz III, I.D., Hale, E.C., Shankaran, S., Kennedy, K., Carlo, W.A., Watterberg, K.L., Bell, E.F., Walsh, M.C., Schibler, K., Laptook, A.R., Shane, A.L., Schrag, S.J., Das, A. and Higgins, R.D. "Eunice Kennedy Shriver National Institute of Child Health and Human Development Neonatal Research Network. Early onset neonatal sepsis: the burden of group B Streptococcal and E. coli disease continues." *Pediatrics*. 127.5 (2011):817-26.
9. Raymond, S.L., Stortz, J.A., Mira, J.C., Larson, S.D., Wynn, J.L. and Moldawer, L.L. "Immunological defects in neonatal sepsis and potential therapeutic approaches." *Frontiers in pediatrics* 5 (2017): 14.
10. Polin, R.A. and Committee on Fetus and Newborn. "Management of neonates with suspected or proven early-onset bacterial sepsis." *Pediatrics* 129.5 (2012): 1006-1015.
11. Visser, V.E. and Hall, R.T. "Urine culture in the evaluation of suspected neonatal sepsis." *The Journal of pediatrics* 94.4 (1979): 635-638.

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12. Mazzucchelli, I., Garofoli, F., Angelini, M., Tinelli, C., Tzialla, C. and Decembrino, L. "Rapid detection of bacteria in bloodstream infections using a molecular method: a pilot study with a neonatal diagnostic kit." *Molecular biology reports* 47 (2020): 363-368.
13. Manroe, B.L., Weinberg, A.G., Rosenfeld, C.R. and Browne, R. "The neonatal blood count in health and disease. I. Reference values for neutrophilic cells." *The Journal of pediatrics* 95.1 (1979): 89-98.
14. Lloyd, B.W. and Oto, A. "Normal values for mature and immature neutrophils in very preterm babies." *Archives of disease in childhood* 57.3 (1982): 233-235.
15. Gerdes, J.S. and Polin, R.A. "Sepsis screen in neonates with evaluation of plasma fibronectin." *The Pediatric infectious disease journal* 6.5 (1987): 443-446.
16. Rozycki, H.J., Stahl, G.E. and Baumgart, S. "Impaired sensitivity of a single early leukocyte count in screening for neonatal sepsis." *The Pediatric infectious disease journal* 6.5 (1987): 440-442.
17. Gabay, C. and Kushner, I. "Acute-phase proteins and other systemic responses to inflammation." *New England journal of medicine* 340.6 (1999): 448-454.
18. Cortese, F., Scicchitano, P., Gesualdo, M., Filaninno, A., De Giorgi, E., Schettini, F., Laforgia, N. and Ciccone, M.M. "Early and late infections in newborns: where do we stand? A review." *Pediatrics & Neonatology* 57.4 (2016): 265-273.
19. Sullins, A.K. and Abdel-Rahman, S.M. "Pharmacokinetics of antibacterial agents in the CSF of children and adolescents." *Pediatric Drugs* 15 (2013): 93-117.
20. Shane, A.L., Sánchez, P.J. and Stoll, B.J. "Neonatal sepsis." *The lancet* 390.10104 (2017): 1770-1780.
21.

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