Neonatal Sepsis and its Associated Risk Factors in Albatool Teaching hospital / Diyala / Iraq

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Abstract

**Background:** Fifty percent of newborns may die because of neonatal sepsis who are not treated. The incidence augmented during the recent years. It may be due to the more public use of aggressive processes and the growth of tough organisms.

**Objective:** To recognize factors (Ante – perinatal) that lead to sepsis (early or late) in newborn period in Albatool teaching hospital/Diyala/Iraq.

**Patients and Methods:** A case-control study done in the Department of Pediatrics in Al-Batool Teaching Hospital, Diyala, Iraq during a period of seven months from Sept 2017 to April 2018. It comprised 200 neonates aged ≤ 28 days. One-handered of them were presented to the hospital because of neonatal sepsis (case group) and the other 100 included neonates presented to the hospital because of other reasons (control group). A questionnaires were used to collect the essential information including demographic and clinical data for the neonates and their mothers.

**Results:** The mean age of neonates was 8.59 ± 7.28 days. Four factors were found to be noteworthy independent risk factors for neonatal sepsis. These factors were prematurity rupture membrane, presence or obscene odor discharge, intrapartum fever, and the prerequisite for resuscitation.

**Conclusion:** Both maternal and neonatal factors had contributed to the risk of neonatal sepsis. The onset of neonatal sepsis was higher in the first week of life.

**Keywords:** Newborn, sepsis, Iraq, risk factors.

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**Introduction**

Neonatal sepsis (NS) is a syndrome of an infant 28 days of life or younger, demonstrated by systemic signs of infection and separation of a bacterial pathogens from the blood\(^1\). Neonatal sepsis (NS) may cause around 3.1 million deaths each year [2,3]. Its incidence amplified during the recent years, it may be due to the further use of invasive
processes and the development of hardyorganisms [4]. Remindful criteria of NS were: Fever (rectal >38°C), hypothermia (rectal <36°C), metabolic acidosis, WBC count ≥30,000/mm or <5,000/ mm, or >25% of immature cells, hypotension and lung symptoms [5]. According to the time and manner of infection, two types of NS can be distinguished: early onset sepsis, occurred during the first seven days of life or during the first 72 hours of life in very low birth weight infants [6] and Late-onset sepsis occurring after the first week of life [7,8]. Group B streptococcus and E. coli together account for around 70% of conditions of early onset neonatal sepsis [9], while 70% of first incidentof late-onset infections were caused by gram-positive organisms, with coagulase-negative staphylococci accounting for about 48% of the infections, in addition to Listeria monocytogenes and Salmonella[10-15]. Both maternal and neonatal factors had subsidized to the risk of neonatal sepsis, as maternal UTI, residence of delivery, premature rupture membrane, intrapartum fever, low APGAR score at 5th minute and not crying soon at birth. While Residence, parity, antenatal care service, mode of delivery, obscene smelling liquor, prematurity and low birth weight are recognized as possible independent risk factors of NS[12-19]. Tests used to establish the diagnosis include blood, urine and CSF cultures, leukocyte profile, platelet count, ESR, C-reactive protein, latex agglutination tests, or counter immune electrophoresis, and polymerase chain reaction (PCR) [14-24].

Residual neurologic damage occurs in 15-30% of neonates with septic meningitis [16,17-28]. Aim of study to recognize factors (Ante – perinatal) that lead to sepsis (early or late) in newborn period in Albatool teaching hospital/Diyala/Iraq.

**Patients and Methods**

Study Design, setting and sample size: A case control study was carried out in the Department of Pediatrics in Al-Batool Teaching Hospital, Diyala Province, Iraq for the period from 1st September 2017 to 30th April 2018. It included 200 neonates (≤ 28 days) who were admitted to Al-Batool Teaching Hospital, 100 of them were presented to the hospital due to NS (cases) and the other 100 included neonates presented without neonatal sepsis (control). The haematological criteria plus the established IMNCI (Integrated Management of Neonatal and Childhood Illness) were used to diagnose NS. Newborns who were not fulfilled the criteria of sepsis and who were admitted to pediatric ward or NICU of Al-Batool hospital were also encompassed with their index mothers as controls. Any newborn with congenital abnormality was excluded from this study. All patients were exposed to detailed history from the mother, full physical examination, and laboratory investigations include: (full Blood Count, CRP and blood culture). A well-structured questionnaire was designed to collect the essential data through interrogating the mothers and revising newborns medical records throughout the data gathering period.
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Data of patients

Age in days, gender, and weight in grams, gestational age, crying directly or not and requisite resuscitation or not), and maternal data included: (Age, residence whether it was rural areas or urban, learning level of mother: separated into Illiterate, primary school, secondary school and higher education), job (Housewife or employer), parity, diseases during pregnancy (Hypertension, bleeding disorder, PROM, and obscene odor discharge), mode of delivery (NVD, C/S), place of delivery (Hospital, Home or health center), ANC attendance, intrapartum fever, and Per-vaginal examination (< 3 cm or ≥ 3 cm).

Ethical consent: The study protocol and the questionnaires were carried out according to principles of the Declaration of Helsinki, as well as revised and accepted by Ethics Research Committee of the College of medicine, university of Diyala. Verbal consents were also taken from the parents and caregivers of neonates involved in the study.

Statistical analysis

The data analyzed using Statistical Package for Social Sciences (SPSS) version 22. The data presented as mean, standard deviation and ranges. Categorical data presented by frequencies and percentages. Pearson’s Chi–square test was used to measure statistical association between sepsis and different variables. Logistic regression analysis was applied using NS as the dependent variable and the variables that showed important association in the binary analysis as the independent variables. A level of P – value < 0.05 was considered significant.

Results

The total number of newborns who were included in the study was 200; 50% were diagnosed as sepsis (cases) and the other 50% without neonatal sepsis (control). The mean age of the newborns was 8.59 ± 7.28 days. The highest percentage of neonates with sepsis were aged <7 days (57.1%) with a substantial relationship (P= 0.014) between age of newborns and sepsis. About 61.2% of neonates with birth weight < 2500 gms complained from NS with a statistically important association between neonatal birth weight and augmented prevalence of sepsis (P= 0.025). It was found that peak proportion of neonates who required resuscitation complained from sepsis (63.3%) with substantial association between resuscitation need of neonates and sepsis (P= 0.001). There was insignificant relationship between sepsis and each of neonate’s gender and abrupt crying (P ≥ 0.05) as shown in Table (1).
### Table (1): Relationship between NS and some neonatal variables

| Neonatal Characteristics | Study Group | | | | | P - Value |
|--------------------------|-------------|---|---|---|---|---|
|                         | Case Group (%) | Control Group (%) | Total (%) n= 200 |
| Age (Days)              |             |               |         |         |         |         |         |
| < 7                     | 68 (57.1)   | 51 (42.9)    | 119 (59.5) | 0.014 |
| 7 - 28                  | 32 (39.5)   | 49 (60.5)    | 81 (40.5)  |         |
| Gender                  |             |               |         |         |         |         |         |
| Male                    | 63 (53.4)   | 55 (46.6)    | 118 (59.0) | 0.25  |
| Female                  | 37 (45.1)   | 45 (54.9)    | 82 (41.0)  |         |
| Birth Weight (gms)      |             |               |         |         |         |         |         |
| < 2500                  | 41 (61.2)   | 26 (38.8)    | 67 (33.5)  | 0.025 |
| ≥ 2500                  | 59 (44.4)   | 74 (55.6)    | 133 (66.5) |         |
| Immediate Crying        |             |               |         |         |         |         |         |
| Yes                     | 84 (48.6)   | 89 (51.4)    | 173 (86.5) | 0.301 |
| No                      | 16 (59.3)   | 11 (40.7)    | 27 (13.5)  |         |
| Need Resuscitation      |             |               |         |         |         |         |         |
| Yes                     | 62 (63.3)   | 36 (36.7)    | 98 (49.0)  | 0.001 |
| No                      | 38 (37.3)   | 64 (62.7)    | 102 (51.0) |         |

There was insignificant relationship between prevalence of sepsis in neonates and all of the general features of their mothers (P ≥ 0.05) as shown in Table (2).

### Table (2): Relationship between NS and general features of study group’s mothers

| Maternal Characteristics | Study group | | | | | P - value |
|--------------------------|-------------|---|---|---|---|---|
|                         | Case group (%) | Control group (%) | Total (%) n=200 |
| Maternal age (years)    |             |               |         |         |         |         |         |
| < 21                    | 15 (45.5)   | 18 (54.5)    | 33 (16.5)  | 0.274 |
| 21 - 34                 | 66 (48.2)   | 71 (51.8)    | 137 (68.5) |         |
| ≥ 35                    | 19 (63.3)   | 11 (36.7)    | 30 (15.0)  |         |
| Residence               |             |               |         |         |         |         |         |
| Urban                   | 42 (46.2)   | 49 (53.8)    | 91 (45.5)  | 0.32  |
| Rural                   | 58 (53.2)   | 51 (46.8)    | 109 (54.5) |         |
| Education               |             |               |         |         |         |         |         |
| Illiteracy              | 17 (48.6)   | 18 (51.4)    | 35 (17.5)  | 0.504 |
| Primary school          | 55 (53.9)   | 47 (46.1)    | 102 (51.0) |         |
| Secondary school        | 11 (37.9)   | 18 (62.1)    | 29 (14.5)  |         |
| Higher education        | 17 (50.0)   | 17 (50.0)    | 34 (17.0)  |         |
| Occupation              |             |               |         |         |         |         |         |
| Housewife               | 92 (49.2)   | 95 (50.8)    | 187 (93.5) | 0.449 |
| Employer                | 7 (63.6)    | 4 (36.4)     | 11 (5.5)   |         |
| Student                 | 1 (50.0)    | 1 (50.0)     | 2 (1.0)    |         |
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The relationship between NS and certain diseases during pregnancy is shown in Table (3). There is a peak proportion of mothers who complained from (UTI/STD, PROM, and presence or obscene of odor discharge during pregnancy and neonates complaining from sepsis (56.3%, 90.3%, and 77.8% respectively) (P=0.005, P=0.001, and P=0.001 respectively).

| Variable                  | Study group | Total (%) | P - value |
|---------------------------|-------------|-----------|-----------|
|                          | Case group (%) | Control group (%) |     |
|                          | n= 100     | n= 100   | n=200     |     |
| Hypertension              |             |           |           |     |
| Yes                       | 17 (60.7)  | 11 (39.3) | 28 (14.0) | 0.221 |
| No                        | 83 (48.3)  | 89 (51.7) | 172 (86.0) |     |
| Bleeding disorders        |             |           |           | 0.06 |
| Yes                       | 11 (73.3)  | 4 (26.7)  | 15 (7.5)  |     |
| No                        | 89 (48.1)  | 96 (51.9) | 185 (92.5) |     |
| UTI or STD                |             |           |           | 0.005 |
| Yes                       | 81 (56.3)  | 63 (43.8) | 144 (72.0) |     |
| No                        | 19 (33.9)  | 37 (66.1) | 56 (18.0)  |     |
| PROM > 18                 |             |           |           | 0.001 |
| Yes                       | 28 (90.3)  | 3 (9.7)   | 31 (15.5) |     |
| No                        | 72 (42.6)  | 97 (57.4) | 169 (84.5) |     |
| Foul smelling discharge   |             |           |           | 0.001 |
| Yes                       | 49 (77.8)  | 14 (22.2) | 63 (31.5) |     |
| No                        | 51 (37.2)  | 86 (62.8) | 137 (68.5) |     |

Table (4) shows the relationship between NS and some obstetrical data. We observed that 72.1% of mothers with GA < 37 weeks had neonates complained from sepsis with a statistically noteworthy relationship between augmented prevalence of sepsis and GA (P=0.003). Multiparous mothers (more than five), had a significant association between NS and parity (P= 0.046). Intrapartum fever during pregnancy, had a significant association with NS (P= 0.001).
### Table (4): The relationship between NS and some obstetrical data

| Variable                  | Study group | Total (%) n=200 | P - value |
|---------------------------|-------------|-----------------|-----------|
|                          | Case group (%) | Control group (%) |   |
|                          | n= 100       | n= 100          |           |
| Gestational age           |             |                 |           |
| < 37 week                 | 31 (72.1)    | 12 (27.9)       | 43 (21.5)| 0.003 |
| 37 - 42 week              | 68 (43.6)    | 88 (56.4)       | 156 (78.0)| |
| > 42 week                 | 1 (100.0)    | 0 (0)           | 1 (0.5)  | |
| Mode of delivery          |             |                 |           |
| NVD                       | 48 (51.1)    | 46 (48.9)       | 94 (47.0)| 0.777 |
| C/S                       | 52 (49.1)    | 54 (50.9)       | 106 (53.0)| |
| Place of delivery         |             |                 |           |
| Home                      | 12 (42.9)    | 16 (57.1)       | 28 (14.0)| 0.415 |
| Hospital                  | 88 (51.2)    | 84 (48.8)       | 172 (86.0)| |
| Parity                    |             |                 |           |
| 1                         | 31 (56.4)    | 24 (43.6)       | 55 (27.5)| 0.046 |
| 2 - 4                     | 44 (41.9)    | 61 (58.1)       | 105 (52.5)| |
| ≥ 5                       | 25 (62.5)    | 15 (37.5)       | 40 (20.0) | |
| ANC                       |             |                 |           |
| Yes                       | 93 (50.0)    | 93 (50.0)       | 186 (93.0)| 1.0 |
| No                        | 7 (50.0)     | 7 (50.0)        | 14 (7.0) |  |
| Intrapartum fever         |             |                 |           |
| Yes                       | 47 (78.3)    | 13 (21.7)       | 60 (30.0)| 0.001 |
| No                        | 53 (37.9)    | 87 (62.1)       | 140 (70.0)| |
| Per vaginal examination   |             |                 |           |
| Yes                       | 57 (54.3)    | 48 (45.7)       | 105 (52.5)| 0.131 |
| No                        | 41 (44.1)    | 52 (55.9)       | 93 (46.5) | |

Logistic regression analysis was applied in Table (5) using NS as a dependent variable and the variables that showed significant association in the binary analysis as the independent variables.

### Table (4): Logistic regression analysis for relationship of different risk factors with NS

| Factors                     | Odds ratio | 95% C.I. | P- value |
|-----------------------------|------------|----------|----------|
|                             | lower      | upper    |          |
| PROM                        | 12.241     | 3.160    | 47.418   | 0.001    |
| Foul smelling discharge     | 4.705      | 2.037    | 10.868   | 0.001    |
| Intrapartum fever           | 3.452      | 1.476    | 8.073    | 0.004    |
| Need Resuscitation          | 2.607      | 1.183    | 5.745    | 0.017    |
Discussion

Epidemiological statistics from developing states shows significant variance in the incidence and risk factors [17]. Despite major improvements in researches in developed countries, 40% of infants with sepsis die or had a neurodevelopmental injury[18]. In this study, four important independent risk factors for NS and these factors were PROM, presence of obscene odor discharge, intrapartum fever, and the requisite for resuscitation which is consistent to an Ethiopian study (2015) [12]. Diverse risk factors detected in Mexico (2014), when only low birth weight, prematurity, abnormal amniotic fluid and any lung complication were recognized as independent risk factors for sepsis[19]. Egyptian study in 2016 noted the peak effect on sepsis was PROM, twin deliveries, multipara mothers and normal vaginal delivery [20]. Lastly, postnatal age and parity are independent risk factors for NS in Chinese study in 2017 [21]. These variances are multifactorial, as the gaps in public services in terms of skilled health staff, supply of crucial drugs, tools, local alterations in bacterial strains and logistics analysis of factors affecting sepsis [22]. Neonatal birth weight drops as a significant risk factor for sepsis 2.75 times greater than normal babies in an Indonesian study in 2010, [23], and in Nepal (2006) [24]. Moreover, American study in 2002 found that late-onset sepsis was a significant risk factor for death amongst very low birth weight infants [25]. This may be explained by fact that somewhat immunodeficiency condition in the premature and low birth weight infant susceptible to the sepsis condition, as a result of invasive processes for diagnostic and therapeutic purposes [24]. Urinary tract infection or sexually transmitted illness had a significant relationship with sepsis in an Ethiopian study in 2015 [12] and in India (2005) [26], Ghana (2014) [27] and Ethiopia (2014) [28]. These might be elucidated by sepsis following the colonization of the birth canal by the infectious agent. In this study, PROM was expressively related to sepsis, in line to another studies in USA (2014)[29], in India (2011) [30], in Nepal (2006)(24), in Pakistan (2014)[31] and a Romania (2010)[32]. But in contrary to that in Saudi Arabia (2002), where insignificant role was described[33]. Early PROM upsurges the chance of ascending microorganisms from the birth canal into the amniotic sac and fetal compromise as well as asphyxia which leads to sepsis [26]. Lastly, Intrapartum fever in this study was meaningfully connected to sepsis, in consistent to that in Ethiopia (2015)(25), in Pakistan (2014)[34] and Bangladesh (2011)[31]. This is clarified by the fact that intrapartum fever is suggestive of maternal infections that are habitually transmitted to the baby in utero or during passage through the canal which usually causes early onset sepsis [35].

Conclusions

This study found that both maternal and neonatal factors had contributed to the risk of
NS, and the onset of NS was higher in the first week of neonate's life.

**Recommendations**

According to the conclusions of the current study, it is recommended that universal screening for rectovaginal GBS colonization of all pregnant women at 35-37 week gestation & screening based approach to selected intrapartum antibiotic prophylaxis for GBS.

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