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Presentation And Outcomes Of Neonatal Sepsisat Beni-Suef University Hospital

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Background: Sepsis is characterized by severe infections caused by many pathogens and subsequent organ failure.

Aim: To identify the signs, symptoms, and outcomes of neonatal sepsis in both the clinic and the laboratoryof university hospital of Beni-Suef.

Methodology: The pediatric department at Beni-Suef University hospital conducted a prospective observational study. One hundred neonates with sepsis were part of the study. In addition to standard laboratory testing (CBC, CRP, and blood culture), all patients had a thorough clinical examination, history recording, and monitoring for complications and outcomes

Results: One hundred people, with an average gestational age of 35.4±2.5 weeks, were part of the study that was diagnosed with neonatal sepsis. At birth, they weighed an average of 2.6±0.7 kg. The emergency room sent 10 patients, the obstetrics and gynecology department sent 35, and other hospitals sent 55. We determined that 76 of the total cases were late-onset neonatal sepsis and 24 were early-onset. Newborn respiratory distress accounted for 81 cases, making it the leading cause of hospitalization.

Conclusions: The most common cause for admitting neonates to Beni Suef University Hospital with neonatal sepsis was respiratory distress. Babies born by cesarean section more susceptible for sepsis than vaginal births .The majority of septic neonates were referred to our unit from other hospital while Klebsiella was the most often diagnosed bacterium. Out of 100 neonates who included in our study, 49 neonates were died.

Key words: neonatal sepsis, mortality, complications, blood culture.

Introduction

Bacteria, viruses, or fungi may cause neonatal sepsis, a systemic disease. It can cause hemodynamic changes and other symptoms, leading to significant harm or even death. We

can classify neonatal sepsis as early-onset, late-onset, or very late-onset based on when symptoms first appear. Babies with sepsis detected beyond the first week of life or between days 4 and 30 are considered to have late-onset neonatal sepsis. When signs and symptoms of newborn sepsis appear during the first three days of a baby's life, rather than after 72 hours, we say that the condition has an early beginning. [1] Over 2.6 million newborns die every year, with 75% of those deaths happening in the first week, according to epidemiological studies [2]. Organisms that enter the body through the mother's vaginal canal or the hospital delivery setting often cause early-onset sepsis. [3]. Typical symptom of newborns with early-onset sepsis (EOS) is respiratory distress, which is associated with high rates of morbidity and mortality [4]. Pathogens brought into the hospital by patients or their caregivers are a common cause of Late onset sepsis [5]. While there has been an uptick in the infant survival rate in neonatal intensive care units (NICU) recently, there has also been an increase in the risks of hospital-acquired infections, a leading cause of neonatal mortality. Severe systemic infections affect over 20% of premature and low birth weight infants admitted to the NICU [6]. Averting disastrous results may be possible with early diagnosis and swift treatment.

Patient and methods

Patients

Prospective observational study was conducted at pediatric department at Beni-suef university Hospital .The study included 100 patients with neonatal sepsis, 63 male and 37 female,76 neonate was delivered by cesarean section and 24 was delivered by normal vaginal delivery

Patients must meet the following diagnostic criteria for infant sepsis in order to participate in the experiment: A baby has sepsis if a blood culture comes back positive and there are other signs of infection, like a rise in C-reactive protein, a drop in white blood cell count (leucopenia or leucocytosis), and a drop in platelet count (thrombocytopenia). In a clinical setting, one may observe symptoms such as temperature changes, low blood pressure, prolonged capillary refill time, irregular heartbeats (tachy or brady), difficulty breathing, restlessness, lack of energy, seizures, poor dietary intake, nausea, vomiting, abdominal distention, yellowing of the skin, abnormal blood vessels, and bleeding.

The following conditions are not eligible for inclusion: severe birth defects, hypoxia, liver disease, kidney failure, cancer, certain drugs (such as linezolid or epinephrine), diabetes mellitus, or metabolic problems that are present at birth.

Ethical considerations:

Ethical considerations: This study received approval from the study Ethics Committee of the Faculty of Medicine, Beni-Suef University, in September 2020. Informed permission was obtained from the guardians of all study participants before to the investigation.

Methods

All participations are subject to:

Comprehensive history acquisition: Maternal medical history: Maternal history of infection during gestation or parturition (kind and duration of antimicrobial treatment), urinary tract infection. Chorioamnionitis, protracted rupture of membranes, difficult delivery, and consanguinity. Medical history of the patient: Gestational age, birth weight, prior NICU admission history, age at admission, reason for NICU hospitalization, and onset timing of sepsis (early or late). Healthcare intervention: Respiratory assistance (nasal, CPAP, mechanical breathing), need for packed red blood cell transfusion, platelet transfusion, or plasma transfusion, necessity for inotropic agents, and length of hospital stay.

Comprehensive clinical evaluation: Birth weight, gestational age per Dobuwitz score, vital signs (heart rate, respiratory rate, temperature, blood pressure), neonatal reflexes such as Moro and suckling, and thorough assessment of all systems including cardiac, respiratory, and neurological (hypotonia, lethargy, seizures, irritability), as well as abdominal examination.
Monitoring of newborns during hospitalization

Laboratory analyses: Complete blood count, C-reactive protein, blood culture

Specimen collection:
Under aseptic circumstances, blood samples were collected from a peripheral vein in order to conduct CRP, CBC, and blood culture tests. The blood sample size ranged from around 3.5 to 4 ml, with 1 ml set aside for CRP analysis, 1.5 to 2 ml for blood culture, and 1 ml for CBC evaluation. We promptly injected 1.5–2 ml of blood into vials of blood culture medium and submitted them to the clinical microbiology laboratory at our hospital to be cultured and processed further.

Methods for Statistics:
SPSS (version 22) and Microsoft Excel (Microsoft Corporation, NY, USA) were used for all statistical analyses. An unpaired t-test was used for inferential research using quantitative variables in two dependent groups with parametric data and the Chi-Square test (X2) for comparisons involving categorical data. Two independent samples were compared using the Mann-Whitney test, whereas three or more independent samples were compared using the Kruskal-Wallis test. Odds ratios (OR) with accompanying 95% CIs were used to depict associations. Statistical significance was defined as a p-value less than 0.05.

Results
Prospective observational study was conducted at pediatric department at Beni-suef university Hospital. The study included 100 patients with neonatal sepsis, mean±SD for gestational age, birth weight , was 35.4±2.5 weeks, 2.6±0.7 kg respectively ,63.0% of patient group were males and 76.0% of them were born by cesarean section

Table (1)Maternal risk factors among the studied patients

Characteristics	Cases (no=100) No. %
Urinary tract infection	0.0 0.0
Chorioamnionitis	2 2.0
Premature rupture of membranes	14 14.0
Prenatal hemorrhage	9 9.0
Preeclampsia	7 7.0
Diabetes mellitus	4 4.0
obstructed labor	5 5.0
Hypertension	11 11.0
Polyhydramnios	22 22.0

This table showed no reported cases with urinary tract infection, only 2% with chorioamnionitis, only 14% with premature rupture of membranes

Table (2) Neonatal history and risk factors among the studied patients:

Characteristics	Cases (no=100) no. %
Referral from other hospitals **Emergency department** **Gynecology &obstetric department**	55 55.0 10 10.0 35 35
Onset of sepsis	
Early	24 24.0
Late	76 76.0
Cause of hospital admission	
Abdominal distension	1 1.0
Convulsions	3 3.0
Encephalocele& respiratory distress	1 1.0
Jaundice	4 4.0
Multiple abscesses & respiratory distress	1 1.0
Poor feeding	1 1.0
respiratory distress only	81 81.0
respiratory distress &convulsions	2 2.0
respiratory distress	1 1.0

&gangrene		
respiratory distress &Fever	1	1.0
respiratory distress &poor feeding	3	3.0
Vomiting& diarrhea	1	1.0
subarachnoid hemorrhage	1	1.0
Head trauma	1	1.0
Respiratory support		
Nasal oxygen	16	16.0
Continuous positive airway pressure	28	28.0
Mechanical ventilation	54	54.0
Blood elements transfusion		
Packed red blood cells	83	83.0
Plasma	65	65.0
PLT	39	39.0
Need to positive inotropes	57	57.0

This table showed 76% had late onset sepsis, and the most common cause of admission was respiratory distress either alone or with other causes.

Table (3) General and systemic examination among the studied patients at admission

Examination		**Cases (no=100)**	
		no.	**%**
Birth weight		2.6±0.7	
vital signs	**Respiratory rate (mean±SD)**	57±18	
	Heart rate(mean±SD)	133±24	
	Temperature(mean±SD)	36.9±0.6	
	systolic blood preasure	73.4±8.5	
	Diastolic blood preasure	43.9±7.5	
Chest	**Apnea**	3	3.0
	Diminished air entry	30	30.0
	fine crepitation	38	38.0
	fine crepitations &wheezes	12	12.0
	wheezes	3	3.0
	Reparatory distress	88	88.0
Gastro intestinal tract	**Poor feeding**	73	73.0
	Vomiting	19	19.0
	Distention	46	46.0
	Jaundice	66	66.0
	Bleeding	63	63.0

central nervous system	**Irritability**	5	5.0
	Lethargy	9	9.0
	Seizures	12	12.0
	Moro reflex		
	Fair	20	20.0
	Good	25	25.0
	Poor	55	55.0
	Suckling reflex		
	Fair	19	19.0
	Good	23	23.0
	Poor	58	58.0

This table showed that the mean heart rate, and respiratory rate ,systolic blood pressure, diastolic blood pressure was 133±24 b/min, and 57±18 breath/minute, 73.4±8.5mmHg, 43.9±7.5mmHg respectively and the most common symptom was respiratory distress

Table (4) outcomes of the studied patients:

Outcomes	**Cases (no=100) N (%)**	
Complications of neonatal sepsis		
Acute kidney injury	1	1.0
Central nervous system infection	7	7.0
Cholestasis	1	1.0
Cholestasis and Central nervous system infection	1	1.0
Necrotizing entrocolitis and Pulmonary hemorrhage	1	1.0
Necrotizing entrocolitis and septic shock	1	1.0
Necrotizing entrocolitis and septic shock and acute kidney injury	1	1.0
Pneumothorax	1	1.0
Pneumothorax and Central nervous system infection	1	1.0
Pneumothorax and Necrotizing entrocolitis	1	1.0
Pneumothorax and Septic shock	2	2.0
Pulmonary hemorrhage	6	6.0
Pulmonary hemorrhage and acute kidney injury	2	2.0
Pulmonary hemorrhage and Septic shock	10	10.0
Pulmonary hemorrhage and acute kidney injury	1	1.0

Pulmonary hemorrhage and Septic shock	2	2.0
Pulmonary hemorrhage and necrotizing entrocolitis	1	1.0
septic shock only	9	9.0
septic shock and acute kidney injury	3	3.0
Septic shock, necrotizing entrocolitis and acute kidney injury	1	1.0
Died	49	49.0
Discharged	51	51.0

This table showed that the most common complication was septic shock either alone or with another complication then CNS infection (7%) followed by pulmonary hemorrhage (6%). Mortality was 51% of septic neonates

Table (5): Results of blood culture in patient group

Culture	Frequency	Percent
No growth	5	5%
Gram negative	70	70%
Gram positive	7	7%
Mixed infection	18	18%

The blood culture isolates showed that 95%of patient group had positive blood culture results with predominance of Gram negative organisms(70%)

Table (6) Microbiological profile found in positive blood cultures of studied group

Blood culture		
Name of organism	Frequency	Percent
Klebsiella	46	46.0
Acinetobacter	12	12.0
Enterobacter	6	6.0
Pseudomonas	5	5.0
Atypical Gram -ve bacilli	1	1.0

Coagulase negative staphylococci	4	4.0
Entrococci	2	2.0
Methicillin resistant staphylococcus	1	1.0
Mixed infection	18	18.0

This table showed that the most frequent organism was Klebsiella (46%) followed by Acinetobacter (12%) and then Enterobacter (6%).

Table (7) Result of tracheal aspirate in patient group

Tracheal aspirate culture		
Name of organism	Frequency	Percent
No growth	20	20.0
Klebsiella	67	67.0
Acinetobacter	5	5.0
Pseudomonas	2	2.0
Atypical Gram -ve bacilli	1	1.0
Gram -ve bacilli	1	1.0
Mixed infection	2	2.0
Escherichia coli	1	1.0
Candida albicans	1	1.0

This table showed that the most frequent organism was Klebsiella (67%) followed by Acinetobacter (5%)

Table (8) Association between mortality and different characteristics of cases:

characteristics	**Alive (no=51)**	**Died (no=49)**	**P-value**
Gestational age (mean±SD)	36.4±1.8	34.4±2.6	<0.001*
Birth weight	2.8±0.5	2.3±0.7	0.001*
Gender			
Female	13(35.1%)	24(64.9%)	0.015*
Male	38(60.3%)	25(39.7%)	
Respiratory support			
Nasal oxygen	16(100.0%)	0(0.0%)	
Continues positive airway pressure	26(92.9%)	2(7.1%)	
Mechanical ventilation	7(13.0%)	47(87.0%)	<0.001*

Blood or blood elements transfusion			
Blood	34(41.0%)	49(59.0%)	
Plasma	17(26.2%)	48(73.8%)	
PLT	5(12.8%)	34(87.2%)	<0.001*
Need to inotropes			
No	40(93.0%)	3(7.0%)	
Yes	11(19.3%)	46(80.7%)	<0.001*
Respiratory Degree			
Complications of neonatal sepsis			
No	47(100.0%)	0(0.0%)	
Yes	4(7.5%)	49(92.5%)	<0.001*
Heart rate	131.6±20.4	133.9±27.2	0.626
Respiratory rate	55.9±21.5	57.5±13.3	0.664
systolic blood preasure	75.3±6.9	71.3±9.5	0.020*
Diastolic blood preasure	45.8±6.7	41.9±7.7	0.009*

* P-value is significant

This table showed that there was a significant association between mortality and younger gestational age , birth weight ,female gender , need to mechanical ventilation, need to platelet transfusion, need to positive inotropic drugs , Complications in NICU, low birth weight, and lower blood pressure.

Discussion

In the first month of life, when normally sterile fluids like blood or cerebrospinal fluid (CSF) harbor pathogenic microbes like bacteria, viruses, or fungi, a clinical syndrome known as neonatal sepsis can develop, causing hemodynamic abnormalities and other systemic symptoms [7]. It significantly impacts neurodevelopmental problems and infant mortality rates [8]. Symptoms, causes, and prognoses of infant sepsis were the foci of this investigation. Our study evaluated a total of 100 infants, 24 of whom were born naturally vaginally and 76 through cesarean surgery. Consistent with previous research, we have found the following: Researchers Seliem and Sultan [9] and Bates et al. [10] found that sepsis was more common in babies born by cesarean section than in vaginal births. On the other hand, compared to babies born by cesarean section, those born vaginally were more likely to develop sepsis [11]. After cesarean sections, neonatal sepsis rates significantly decreased, potentially due to the effectiveness of sterilization and intrapartum chemoprophylaxis.

Hamam et al. [12] found that neonates with neonatal sepsis had an average birth weight of 2.309±0.770 kg, which is in agreement with our patients' average weight of 2.6±0.7 kg. While Smertka M et al. [13] did not find a connection between low birth weight and an increased risk of sepsis, Schrag [14] did. Seventy percent of the women in our study had no history of problems during pregnancy, fourteen percent experienced premature membrane rupture (defined as occurring within the first eighteen hours), and two percent showed signs of chorioamnionitis. Only 8 cases showed pre-eclampsia and pregnancy-induced hypertension. Maternal illness in the form of gestational diabetes mellitus affected four cases (four percent), while obstructed labor affected five percent of the deliveries. That is in line with the findings of the 2014 study by Idris AA et al., [15] which found that 22.2% of the mothers whose babies had sepsis also had PROM. Conversely, Abdou et al. [16] found that 51.6% of the assessed pregnant women had no history of pregnancy complications. Of those, 8.9% had obstructed labor, 7.8% had eclampsia or pregnancy-induced hypertension, and 3.8% had PROM. The same percentage of women also had chorioamnionitis.
Out of 100 case, 55 case referred from anther hospital, 35 were born at Beni-Suef university Hospital, 10 were admitted from emergency department at Beni-Suef university Hospital, against our results Ingale et al., [17] (found that (74.5%) of the infected babies were inborn. Regarding onset of neonatal sepsis 76% of our patients had late on set sepsis, 24% had early onset sepsis , the same results found by Gaballah et al.,2022[18]457 out of 2,400 newborns (19%) positively recognized the prevalence of sepsis. Gosalia et al. [19] found that 181 patients (39.6%) had early onset newborn sepsis (EOS), while 276 cases (60.4%) had late onset neonatal sepsis (LOS).

One possible explanation for the high number of LOS cases is the high number of invasive operations that preterm and low birth weight babies undergo, including endotracheal intubation and intravenous catheter placement. Abdelaziz et al. [20] found the opposite: early-onset sepsis in 130 patients (64.4%) and late-onset sepsis in 72 instances (35.6%). Based on the findings of this study, respiratory distress accounted for 90% of NICU admissions, either alone or in combination with other reasons. Convulsions accounted for 5% and jaundice for 4%.
The most common symptoms of neonatal sepsis, according to Shehab et al. [21], are difficulty breathing (54.6%), yellowing of the skin and eyes (4.9%), fluctuating body temperature (2.3%), and seizures (1.6%). Consistent with previous research [22], the most common cause for NICU hospitalizations (63.4% of cases) was respiratory distress, which includes hyaline membrane disorders, meconium aspiration syndrome, and fetal asphyxia. Shortly after, congenital cardiac disease was found in 9.5% of cases, and hypoglycemia was present in 4.8%. Also in agreement with these findings is Abdou et al. [16]. We found that respiratory distress (at 88% of patients), poor eating (73% of patients), and jaundice were the most common clinical symptoms of newborn sepsis. This confirms what West and Tabansi [23] found; they identified fever (26.6% of cases), poor sucking (22.5% of cases), jaundice (14.2%), and respiratory distress (30.2% of cases) as the most prevalent clinical signs of septicemia. Research by Basu and Bandyopadhyay [24] and Lakhey and Shakya [25] confirms that respiratory distress is the most common symptom of sepsis.

Our findings contradicted previous findings. The main symptoms of neonatal sepsis, according to Verma et al. [26] and Shalaby et al. [27], include a lack of interest in eating and insufficient suctioning.
According to our data, septic shock is the most common occurrence, either alone or in conjunction with another problem; second most common were central nervous system infections (7% of cases) and pulmonary bleeding (6% of cases). On the other hand, Al-Matary et al. [28], conducted a study in 2019. In 126 instances) (59.4%), the most frequent outcome of neonatal sepsis was chronic lung disease (CLD). In 113 cases (53.3%), the second most common consequence was a longer hospital stay that exceeded 120 days. In 63 cases (23.8%), the third most common consequence was necrotizing enterocolitis(NEC). Supporting the results of Jumah DS [29],, this study found that while 49% of the infants tested died, 51% showed improvement and were discharged from the NICU.There was a 44.2% significant mortality rate among the 29 individuals. Also, in 2019, Hamam et al. [12],documented mortality rates hover around 57.24%.

On the other hand, a study that looked at the pattern of microbial illnesses in the first 72 hours of a newborn's life in the NICU at AlKhafji General Hospital in Saudi Arabia found that only 12.2% of those babies died from infections [30]. Additionally, Ingale et al.,[17]. reported a lower death rate (20.7%) among infected infants. Blood cultures most commonly contained Klebsiella (46%), Acinetobacter (12%), and Enterobacter (6%). In a similar vein, Gaballah et al. [18]. carried out studies in Egypt. Klebsiella emerged as the most common pathogen, accounting for 54 percent (18 isolates). Hamam et al. [12]. reported that Klebsiella caused 22.89% of the 145 instances of sepsis at Tanta University Hospital in Egypt. According to Utomo et al. [31], Klebsiella is the primary pathogen in neonatal sepsis, as confirmed by culture [31], in Indonesia and other countries that use it [32, 33]. Eltaib L and Alshammari HA [30] discovered that Pseudomonas aeruginosa (13.5%) and other gram-negative bacteria were the main pathogens responsible for illnesses in infants, which contradicts our results. Additionally, in 2019, Thapa and Sapkota [34] conducted research in Nepal. Acinetobacter species (32.1%) and Staphylococcus aureus (19.6%) were the most frequently isolated bacteria.

Conclusion:
Among neonates who admitted at Beni-Suef university hospital with neonatal sepsis Sepsis was more common in babies born by cesarean section than in vaginal births .The majority of septic neonates were referred to our unit from other hospital, the most common cause of admission was respiratory distress, while the most common isolated organism was klebsiella. Septic shock was the main complication leading to death. The survival incidence was 51%. Prematurity, low birth weight, female gender, mechanical ventilation, platelet transfusion, Complications in neonatal intensive care unit during staying , intravenous infusion of positive inotropic drugs, and lower blood pressure were considered risk factors for death .AS there were significant associations between these parameters and mortality

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