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Neutrophil: Lymphocyte Ratio, Mean Platelet Volume and Serum Uric Acid as a Diagnostic and Prognostic Marker of Neonatal Sepsis

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Abstract

Background: Neonatal sepsis is still a significant cause of morbidity and mortality.

Aim of Study: Was to determine the typical pathogens that cause neonatal sepsis in neonates admitted to the neonatal intensive care unit, to determine the impact of neonatal sepsis on blood results, and to determine the significance of mean platelet volume, uric acid levels and neutrophil lymphocyte ratio in the early diagnosis of neonatal sepsis.

Patients and Methods: The study involved seventy cases and 70 matched healthy neonates that were recruited. All newborns had been examined with emphasis on the perinatal history, maternal history and focus on newborn risk factors. Sepsis screen was done in addition to mean platelets volume and uric acid serum levels.

Results: MPV was used as a predictor for sepsis diagnosis: at the cutoff value of 9.15 fL had a sensitivity of 88% and specificity of 70% with a positive predictive value (PPV) of 50%, negative predictive value (NPV) of 94.9% and accuracy of 75%. Used as a predictor of sepsis diagnosis, serum uric acid had a PPV of 60.5%, NPV of 88.2%, and accuracy of 20%. It also had a sensitivity of 65.7% and specificity of 85.7%.

Conclusions: Mean platelets volume, uric acid and neutrophil: Lymphocyte ratio serve as early indicators of neonatal sepsis as compared to the blood culture in diagnosis of neonatal sepsis diagnosis.

Key Words: *MPV – Uric acid – Neonates – Sepsis – NICU – NLR.*

Introduction

NEONATAL sepsis, one of the most common newborn diseases, is still a significant cause of morbidity and mortality. Sepsis can be the cause of 13%-15% of all neonatal fatalities in impoverished countries, where it may account for as much as 50% of newborn mortality **[1]**. Neonatal sepsis is defined as a clinical condition that affects newborns younger than 28 days old and is characterised by the isolation of a bacterial pathogen from the bloodstream and systemic signs and symptoms of infection **[2]**.

Neonatal sepsis can be classified as early (three days old) or late (older than three days) depending on when it first appears. The difference is clinically significant because early onset sepsis is mostly caused by bacteria obtained before and during delivery, whereas late onset sepsis is primarily caused by bacteria acquired after delivery (hospital-acquired or environmental sources) **[3]**. Fatal septicemia may occur rapidly in infants, especially premature and low birth weight neonates, who lack efficient structural barriers, a shielding endogenous microbial flora and a developed immune system **[4]**. As a result, it has been standard practice to administer antibiotics at birth.

A few of the therapeutic treatments that newborns in NICU are subjected to include intubation, breathing, central venous catheters, total parenteral nutrition (TPN), peripheral intravenous lines, venipuncture or needle stick blood samples, and urine

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Abbreviations:

CONS : Coagulase negative steptococci.
CRP : C-reactive protein.
CSF : Cerebrospinal fluid.
MRSA : Methicillin resistant staph aureus.
MDR : Multiple drug resistant.
MPV : Mean platelet volume.
NEC : Necrotising enterocolitis.
NLR : Neutrophil lymphocyte ratio.
NS : Neonatal sepsis.
NPV : Negative predictive value.
PPV : Positive predictive value.
PROM : Premature rupture of membranes.
TPN : Total parenteral nutrition.

catheters. These therapies increase the risk of newborn infections in these infants [5]. Neonatal sepsis is caused by a variety of Gram-positive and Gram-negative bacteria, as well as occasionally fungi. Numerous microbes can cause neonatal sepsis, and these germs differ between countries due to regional patterns of antibiotic use. The bacteria that cause neonatal sepsis also have a changing ecology and niches [6].

Numerous studies have shown that haematological indicators are quick, simple, and inexpensive diagnostic tools for the early identification of infant sepsis. When these tests are looked at together as a collection, both sensitivity and specificity increase. They are useful early indications of infant septicemia and can help in the early start of treatment with the right antibiotics [7].

The aim of the study was to determine the significance of neutrophil: Lymphocyte ratio, mean platelet volume (MPV), and serum uric acid levels in the early diagnosis of neonatal sepsis before the results of blood cultures. We also aimed to identify the common bacteria that cause sepsis in infants admitted to the Kasr Al-Ainy NICU as well as the mechanism of neonatal sepsis.

Patients and Methods

Study setting:

This cross-sectional study was carried out at the NICU in our hospital, from January to August 2018. The study included newborns who were either full term or preterm, of both sexes, had sepsis-related clinical symptoms and signs within the first month of life, as well as laboratory evidence of sepsis (leukocytosis or leukopenia, elevated immature to total neutrophil ratio, thrombocytopenia, and increased CRP).

Study population:

A total of 70 neonates were enrolled as cases and compared to a matched set of 70 healthy neonates who were given the designation of the control group. The study excluded newborns who had undergone surgery in the previous week, had chromosomal abnormalities, or lacked parental permission. Written consent was ensured. The required official authorizations were all received. The study was approved by the local ethical committee.

The National Newborn Forum of India [8] served as the foundation for the criteria for diagnosing neonatal sepsis. If one of the following conditions was present, it was considered to be probable (clinical) sepsis. These conditions included respiratory distress, poor perfusion, decreased activity, convulsions, temperature instability, jaundice, abdominal distention and poor feeding. Total leucocytic count (TLC) (>5000/mm^3), band to total polymorphonuclear cells ratio of >0.2, absolute neutrophil count 1800/gL, C-reactive protein (CRP) >1mg/dL, and radiological evidence of pneumonia were the two conditions that indicated a positive septic screen. Predisposing variables included the presence of maternal fever, foul-smelling liquor, or prolonged membrane rupture (lasting more than 24 hours). Culture-positive sepsis is defined as having a clinical picture suggestive of septicemia, pneumonia, meningitis from blood, cerebrospinal fluid (CSF), urine, or abscess if either of two isolated bacteria is present.

Study tools:

All neonates had thorough examinations, and full medical histories of the parents were recorded. The mothers' medical history included diabetes, chorioamnionitis, urinary tract infection (UTI), hypertension, preeclampsia, and Premature rupture of membranes (PROM) >18 hours. All participants had venous blood samples drawn for blood cultures, complete blood count (CBC), and serum uric acid. Blood samples were taken for the initial sepsis laboratory examination within 24 hours of the onset of symptoms. Three millimetres of venous blood samples were drawn and divided into one 1mL parts according to the manufacturer's instructions for CBC testing using a Sysmex 800 coulter. Platelet count and MPV were reported from the CBC results. The neutrophil: lymphocyte ratio was calculated.

One millilitre of venous blood was placed into an anticoagulant-free sterile vacutainer, allowed to clot for 15 minutes, and then centrifuged for 10-15 minutes. The serum was then used to measure serum uric acid on a Beckman Coulter AU 480 analyzer and serum CRP on a Latex test strip. Values were considered high if they were greater than 6mg/dL. The manufacturer's instructions for each assay were strictly followed. Blood culture Bactec Bottle filled with 1mL of venous blood was placed onto BACTEC ALERT 3D 60. Blood was cultivated using an automated method and incubated for 14 days; if a bottle had positive flags, a Gram stain was carried out and blood and Macckonkey agar were subcultured. Due to their growth characteristics, antibody sensitivity, and biochemical characteristics, all isolates from positive bottles were identified on the basis of growth characteristics antibody sensitivity and biochemical profile (API, bio Merieux Vitek Inc., Haze Lwood, Mo.)

Data management and statistical analysis:

Microsoft Excel 2010 and the statistical programme SPSS version 24 for Windows (SPSS Inc., Chicago, IL) were used for data management and analysis. Statistics were used to portray the numerical data as range, mean, and standard deviation. Percentages were used to summarise categorical data. For parametric data, Student's unpaired *t*-test was used to compare numerical variables between groups. Age differences were assessed using a one-way ANOVA, and categorical variables were compared using the Chi-square test. Area under the curve (AUC) and receiver operating curve (ROC) analyses for MPV, NLR, and SUA were computed for each plot. The Pearson test was applied to determine the association between the various parameters. Tables, pie charts, and bar charts were used to visualise important data.

Results

Demographic and clinical data were illustrated in the Tables (1,2). Regarding maternal illness and risk factors, the most common illnesses were PROM >18 hours (27.1%), pre-eclampsia, eclampsia, pregnancy-induce hypertension (24.3%), and diabetes (22.9%), chorioamnionitis (14.2%), placental insufficiency (10%) in septic cases. Overall, 70 cases had perinatal complications. Respiratory distress represented the most common (97.1%) followed by apnea (30%), then bradycardia and arrest (11.4%). Various signs of sepsis were detected in our cases. The most common signs were poor activity (88.6% of the cases), abdominal symptoms (81.4%), poor perfusion (80%), respiratory distress (50%), suspected NEC(40%), sclerema (35.7%), bleeding tendency (18.6%), apnea and temperature instability (17.1% each); the least common sign was convulsions (2.9%).

Table (1): Important demographic data of studied cases.

Data	Number = 140 (%)
Sex:	
Females	35 (50%)
Males	35 (50%)
Mode of delivery:	
VD	16 (22.9%)
CS	54 (77.1%)
Admission weight:	
ILB W	0 (0%)
ELBW	4 (5.7%)
VLBW	30 (42.9%)
MLB W	25 (35.7%)
NB W	11 (15.7%)
Single or multiple gestation:	
Single	60 (85.7%)
Multiple	10 (14.3%)

ILBW : Incredibly low birth weight. VD: Vaginal delivery.
ELBW : Extremely low birth weight. CS : Cesarean section.
VLBW : Very low birth weigh.
MLBW: Moderately low birth weight.
NBW : Normal birth weight.

Table (2): Mean, minimum and maximum for important obstetric data.

	Study group (n=70)				Control group (n=70)			
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum
G.A	32	3	27	38	35	2	34	38
Birth weight	1744	745	110	3800	2115	262	1800	3800
APGAR1	2	2	0	5	5	3	1	5
APGAR5	6	1	0	9	9	1	5	9
APGAR 10	8	1	5	10	8	1	7	10

Table (3): Distribution of organisms in blood culture.

Organism	Number of positive cultures (n=64) (%)
Klebsiella MDR	24 (68.5%)
Pseudomonas MDR	7 (20%)
MRSA	5 (14.2%)
E. Coli	2 (5.7%)
Acinetobacter MDR	2 (5.7%)
CONS	2 (5.7%)
Candida	1 (2.8%)

MRSA: Mecithillin resistant staph aureus.
CONS: Coagulase negative steptococci.
MDR : Multiple drug resistant.

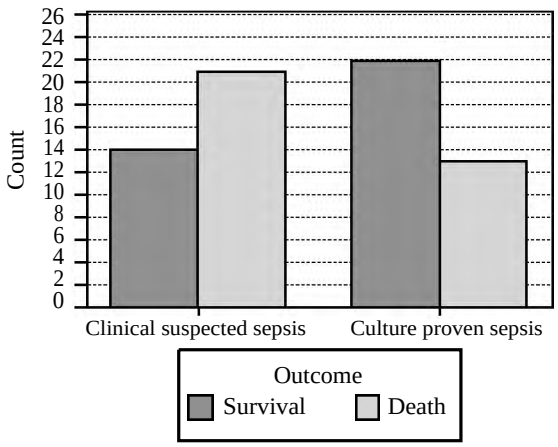

Fig. (1): Outcome of neonates with sepsis.

Table (4): Comparison of laboratory findings between the three groups.

	Clinical suspected		Culture proven sepsis		Control (70)		*p*-value
	Mean	SD	Mean	SD	Mean	SD	
White blood cells/mm ^{3}	12286	6367	19146	9404	8592	2028	0.001
Neutrophil	63	10.5	70	14	55	7	0.001
Neutrophil lymphocyte ratio	1.8	0.3	2.6	0.95	1.3	0.24	0.001
Mean platelet volume fl	10.5	1.2	10.36	1.2	8.2	0.36867	0.001
Serum Uric Acid mg/dl	2.5	1.2	1.3	0.7	4.4	0.59	0.001
Platelet Count/ml	141	80	100	28	333	107	0.001
Lymphocyte	37	7	29	9	42	7	0.001
Hemoglobin gm/dl	14.5	2.3	13.9	2.9	14.7	1.7	0.015
CRP mg/l	53.00	18.067	146.06	44.572	9	6.5	<0.001

*Data are represented as mean and SD.

Table (5): Predictive values of NLR, MPV and uric acid levels.

	Cutoff	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy rate	AUC	±SE	*p*-value
A- White blood cell	12.5x 10 ^{3}	71.4	95.2	83.3	90.9	89.3	.835	.043	<0.001
B- NEUTROPHIL	62	68.6	88.6	66.7	89.4	83.5	.761	.053	<0.001
C- NLR	1.85	77.1	94.3	81.8	92.5	90	.958	.015	<0.001
D- Mean platelet volume	9.15 fl	88	70	50	94.9	75	.796	.040	<0.001
E- Serum uric acid	2.25	65.7	85.7	60.5	88.2	20	.168	.041	<0.001

MPV: Mean platelets volume.
NLR: Neutrophil lymphocyte ratio.

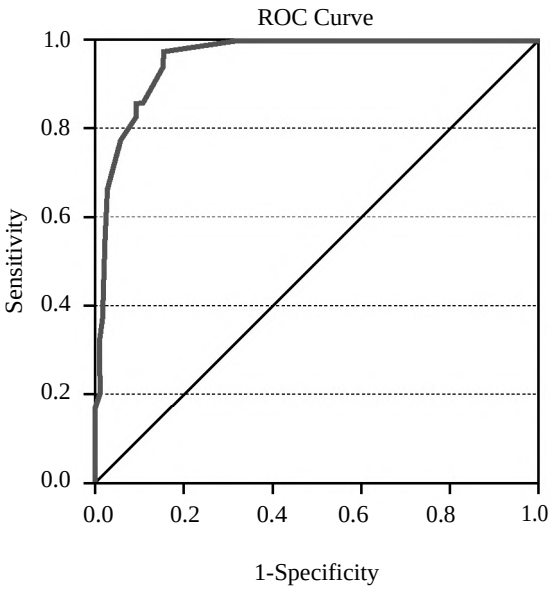

Fig. (2): ROC curve for neutrophil lymphocyte ratio.

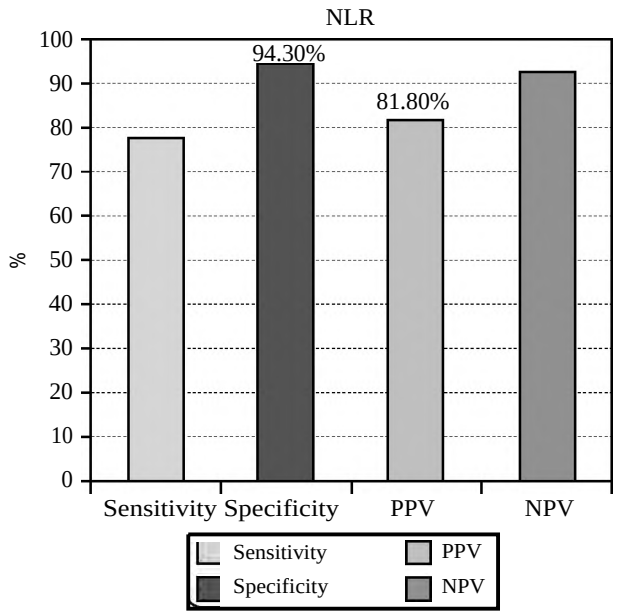

Fig. (3): Sensitivity, Specificity, PPV and NPV of NLR.

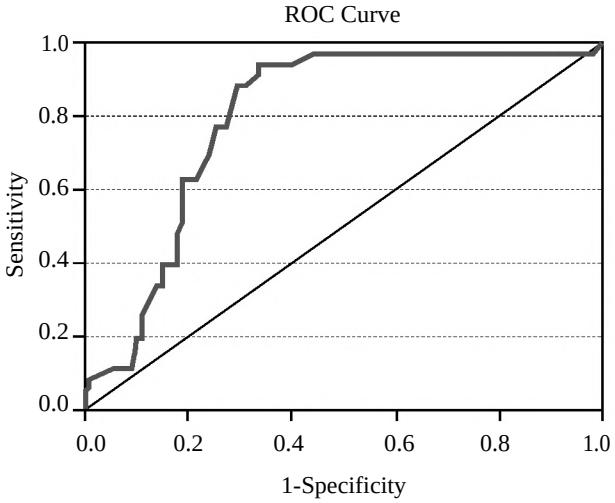

Fig. (4): ROC curve for Mean platelet volume.

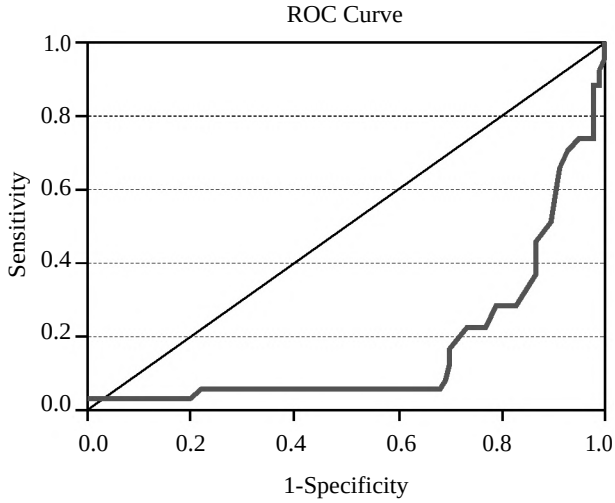

Fig. (5): ROC curve for serum uric acid.

Table (6): Correlation between NLR, MPV and Serum uric acid and other parameters.

	Serum uric acid		MPV		NLR	
	r	*p*-value	*r*	*p*-value	*r*	*p*-value
G.A	.303	<0.001	–.413	<0.001	–.391	<0.001
Birth Weight	.162	.056	–.225	.008	–.274	.001
WBCS	–.328	<0.001	.345	<0.001	.560	<0.001
Platelet Count	.430	<0.001	–.582	<0.001	–.437	<0.001
CRP	–.006	.959	–.136	.263	.323	.006

NLR : Neutrophil lymphocyte ratio. WBCS : White blood cells.
GA : Gestational age. MPV : Mean platelets volume.

Discussion

A systemic illness known as neonatal sepsis, which affects infants younger than 28 days old, is a major factor in the morbidity and mortality of newborns **[9]**. Because clinical signs are non-specific and none of the currently available laboratory tests can be regarded as an optimal diagnostic, diagnosis can be challenging. A combination of indicators has been suggested as a result, however automated blood culture is still the preferred method for diagnosis **[10]**. Newborns, especially premature ones, are more vulnerable to life-threatening illnesses. Excellent sensitivity, NPV, and PPV are all characteristics of the perfect diagnostic biomarker **[11]**.

Less developed preterm infants are more susceptible to encounter sepsis-related issues because they lack humoral and cellular defenses. Because transplacental maternal antibodies primarily promote humoral immunity, preterm infants are less likely to receive as much immunoglobulins as term infants. Furthermore, neither T-cell nor phagocytic function are present **[12]**.

The onset of sepsis in infants can be classified as early or late. Most pathogens that cause early-onset neonatal sepsis (EONS) are maternal infections of the gastrointestinal tract and birth canal. The most common pathogens are Gram-negative bacteria, and their symptoms are frequently severe. Instead, late-onset neonatal sepsis (LONS) develops three days after birth, with Staphylococcus spp. being the most often observed pathogens **[13]**.

This cross-sectional study was carried out at NICU of Kasr Al-Ainy Hospital, Cairo University, Egypt, from Janurary 2018 to August 2018.

The study's objectives were to identify common pathogens in Kasr Al-Ainy NICU that result in neonatal sepsis, identify the impact of neonatal sepsis on blood analysis, and identify the role of serum uric acid, MPV, and NLR in the early diagnosis of neonatal sepsis. In the current study, sepsis was clinically and/or laboratory diagnosed in 140 newborns admitted to Kasr Al-Ainy NICU during the study period. In our study, males made 50% of all subjects. This agreed with a number of research **[2,11,14,15]**. The likelihood of a sex-related element

in sepsis vulnerability is considered. Due to the fact that boys only have one X chromosome and so are more susceptible to newborn septicemia than females, the production of gamma globulins is likely controlled by X-linked immunoregulatory genes [16]. Sex of the recruited neonates were determined by the external examination of the neonates.

The mean gestational age of the examined septic neonates in our study was 33 weeks, and 77.1% of the babies were delivered via caesarean section. The typical newborn weighed 1744 grams. At the first and fifth minutes, the average APGAR score was 3 and 6, respectively. It was discovered that while 51.5% of cases survived, 48.5% of them did not (Fig. 1). In contrast, a 2017 prospective study done in a private tertiary institution in Nigeria found that the mortality rate was only 12%. The case fatality rate is significantly lower in developed nations, largely as a result of better management procedures for neonatal sepsis [17]. In a 2018 study on 127 cases of early-onset sepsis conducted in Canada, the overall case mortality was only 1 1% (17% among preterm cases and 3% among term cases) [14].

It worth mentioning the results of the prospective cohort research, which recruited 418 neonates with sepsis who were admitted to the Zagazig NICU. In that study, the mean gestational age was 35 weeks, and the majority of the subjects (57.3%) were female. The typical newborn weighed 2285 grams. At the first and fifth minutes, the average APGAR score was 5.85 and 7.17, respectively. Additionally, it showed that of the neonates hospitalised, 76.6% made a full recovery and only a minority (23.4%) perished [18,19].

Preterm birth and low birth weight have been linked to negative outcomes, according to other studies. Because transplacental maternal antibodies primarily promote humoral immunity, preterm infants are less likely to receive as much immunoglobulins as term infants. Additionally, phagocytic and T-cell function are absent [12,20].

Thus, these findings demonstrate that prematurity is one of the most critical cofactors that can be reliably related to greater perinatal morbidity and mortality in NICUs. This study and prior studies [21] identified prematurity as a risk factor for sepsis because it has been demonstrated that in terms of sepsis symptoms, Poor activity (88.6% of cases), abdominal symptoms (81.4%), poor perfusion (80%), respiratory distress (50%) and suspected NEC (40%) were the most frequent signs in our study. Sclerema (35.7%), bleeding tendency (18.6%), severe apnea (17.1 %), and temperature instability (2.9%) were the least frequent signs. These results are comparable to those of a prospective research conducted in 2016 in which the main clinical symptoms were feed refusal (64%), abnormal temperature (45%), jaundice (28%), pallor (20%), and convulsions (6%) [22].

In our investigation, the most prevalent conditions for maternal sickness and risk factors for newborn sepsis were PROM >18 hours (27.1%) pre-eclampsia, eclampsia, pregnancy-induced hypertension (24.3%), and diabetes (22.9%), followed by chorioamnionitis (14.2%), placental insufficiency (10%), and (14.3%) multiple gestations among mothers. Respiratory distress was present at admission in 71.4% of the individuals in our study. Overall, 60% had an endotracheal tube placed (mechanically ventilated). These results are close to those of a prospective research carried out in 2014, in which respiratory distress syndrome was present in 68% of cases and an endotracheal tube was placed in 65.2% [18].

Overall, 35 cases (50%) had sepsis-related positive blood cultures, while 35 cases (50%) had sepsis-related negative blood cultures, according to the distribution of organisms in blood cultures. The most frequent bacterium found was Klebsiella multiple drug resistant (MDR) (68.5%), which was then followed by Pseudomonas MDR (20%), Methicillin-resistant Staphylococcus aureus (MRSA) (14.2%), coagulase-negative staphylococci (CONS) (5.7%), Acinetobacter MDR (5.7%), Escherichia Coli (5.7%), and Candida (2.8%). According to a 2014 study, E. coli (11.2%), Pseudomonas aeruginosa (14.9%), Staphylococcus aureus (26.1%), and Klebsiella (34.2%) were the most frequently isolated microorganisms (Table 3).

However, CONS were the most prevalent infections, followed closely by Staphylococcus aureus, Klebsiella pneumoniae, and Pseudomonas aeruginosa, according to a 2017 prospective study conducted in an Indian tertiary hospital. The other three were E. coli, Proteus mirabilis, and Acinetobacter baumanni [15]. These findings are in line with a 2016 prospective analysis in which Klebsiella was identified in 56 cases (48.2%), Staphylococcus aureus in 32 cases (27.6%), Acinetobacter in 10 cases (17.2%), E. coli in four, and Pseudomonas in four cases (3.5%). Of note, the study done by Hashem et al found that CONS is the second most common organism after klebsiella in pecrcentages of 15.9% and 17% respectively [22,23].

The MPV was greater in Groups I (clinical NS) and II (culture-verified NS) than in Group III (healthy control), according to the findings of the current investigation (mean ± SD = 8.2±0.3, in the control group). MPV as a sepsis diagnostic predictor with a cutoff value of 9.15 fL had a sensitivity of 88%, specificity of 70%, PPV of 50%, NPV of 94.9%, and accuracy of 75%. Also serum uric acid as a predictor for diagnosis of sepsis with a cutoff value of 2.25, had PPV of 60.5%, NPV of 88.2%, the accuracy of 20%, the sensitivity of 65.7%, and the specificity of 85.7% (Table 4). When compared to Group I, i.e. clinically suspected sepsis, Group II culture-proven sepsis and Group lll (control), Group II had the lowest uric acid levels in our study (Tables 5,6, Figs. 4,5). This is in agreement with Patrick et al., **[24]** who evaluated 156 newborns and showed that MPV was considerably higher in patients with bacteremia compared to those without NS and O'Connor et al. **[25]**.

A comparable prospective research was also conducted in the NICUs of El-Minia University Hospital. When compared to Groups I (clinically suspected sespsis) and III (control group), which included 140 neonates, patients in Group II (culture proved sepsis) had the highest CRP values, the lowest platelet counts, and the highest uric acid levels. There was no difference between Groups I and II, while MPV values were greater in Groups I and II compared to group III (p=0.001) **[26]**.

This is in line with a prospective trial in which 146 newborns with suspected NS and 142 neonates without NS (the control group) were prospectively assigned to the study. Group I (n=64) for clinical NS, Group II (n=82) for NS that had been seen in culture, and Group III (n=142) for healthy controls were the three patient groups that were established. Patients in Group II had the lowest platelet counts (199,329135,952/mm^3), highest CRP values (54.6± 5.4mg/dL), and highest uric acid levels (2.6 ± 1.8mg/dL) when compared to Groups I and III (p≤0.05, for all comparisons) **[27]**.

MPV levels were higher in Group I (10.6± 1.1 fL) and Group II (10.4±0.9 fL) than in Group III (9.2± 1.2 fL), despite the fact that there was no difference between Groups I and II (p=0.001). The diagnostic threshold values 10.4 fL was the diagnostic threshold for MPV. In NS, MPV had a sensitivity and specificity of 54% and 82%, respectively. Its sensitivity and specificity rose to 89% and 79%, respectively, when coupled with CRP **[27]**.

Thrombocytopenia was well-established in our study with all types of sepsis but was more obvious with fungal sepsis, which is consistent with two studies conducted in 2004 and 2000 that demonstrated a link between fungal sepsis and a higher degree of thrombocytopenia **[28,29]**. Additionally, sepsis brought on by necrotizing enterocolitis and gram-negative sepsis have also been well reported by Scheifele D.W., et al. **[30]**.

While some authors came to the conclusion that high MPV in the first few hours of life might be a sign of a risk factor for the development of necrotising enterocolitis (NEC), bronchopulmonary dysplasia, and intraventricular haemorrhage in extremely preterm infants, other authors contend that higher MPV values were not linked to the development of sepsis as in a sizable prospective study conducted in 2014 **[31]**.

In a 2003 study of patients with culture-positive sepsis and birth weights <1,500g, it was discovered that thrombocytopenia was associated with 54% of sepsis episodes while an increase in MPV was associated with 61% of sepsis episodes. Our findings are in line with two prospective investigations that were carried out in 1993 and 2014 **[25,33]**.

This phenomenon was explained by a plasma-bridging molecule that links the bacterial and platelet surface receptors, which is characterised by the binding of bacteria to platelets either directly through a bacterial surface protein or indirectly through a plasma-bridging molecule.

Two comparable studies **[34,35]** that looked at serum uric acid levels backed up our finding that NS had lower levels. Some authors claimed that the quick release of inflammatory mediators upon interaction with vascular endothelial cells, which in turn triggers a rapid cascade of events, explains this discovery. While Chia et al., found greater uric acid levels among neonates with neonatal sepsis(NS) and considered it to be an additional risk factor in critically unwell infants with sepsis **[36,37]**.

In our study about NLR ratio as a prognosis for diagnosis of sepsis, Group II (2.6 ±0.95) values were higher than Group I (1.8 ±0.3) and Group III (1.3±0.2) (p<0.05). NLR (with the threshold value of 1.82) had a PPV of 81.8%, a sensitivity of 77.1%, and a specificity of 94.3% (Table 5, Figs. 2,3). In a prospective observational study that was conducted in the level III neonatal intensive care unit (NICU) at the Tepecik Training and Research Hospital between January 2014 and January 2015, 127 patients were enrolled, according to the Ozdemir et al. study. The birthweight was 11 14.6g,

the gestational age was 28.0 ±2.5 weeks, and the postnatal age was 20.5 ± 15.1 days. According to the findings of the blood culture, the neonates were split into two groups: Group I (culture-proven sepsis; n = 52; 40.0%) and Group II (suspected sepsis; n = 75; 59.0%). When compared to suspected septic infants, there was a statistically significant increase in NLR in preterm infants with septic cultures (mean 3.69 ±3.0 versus 1.56± 1.83, p<0.001) **[38]**.

The NLR values of septic newborn babies and healthy newborns were compared in the 2018 study, and it was shown that the septic newborn babies' NLR levels were significantly greater. The values of sensitivity and specificity were observed to be 80% and 57.1 %, respectively, with a cutoff point of 2.7 for total leukocyte and neutrophil **[39]**. Two indicators of infection; Leukocytosis is a sign of infection, though leucopenia can signify a serious infection. Low diagnostic value for infant sepsis was associated with reported leukocyte counts, according to Poyoa et al. and Sierra et al. **[40,41]**.

The presence of neutrophilia and lymphopenia suggested bacterial infection. It boosted the NLR in newborns with sepsis. According to a 2016 prospective study, a greater NLR was linked to more serious sepsis and a higher mortality rate. The NLR is incorporated into standard blood analysis, increasing cost efficiency and facilitating sepsis prediction **[42]**.

Conclusions and suggestions:

When used in conjunction with MPV and serum uric acid in the newborn period, the prediction of NLR, a quick, low-cost way to diagnose sepsis, will be more successful in identifying cases of the condition and reducing the need for antibiotic treatment. In cases where a culture was positive, Klebsiella MDR and Pseudomonas were the most often recovered pathogens. Prior to the results of blood cultures, which might take up to 14 days, the three indicators exhibited a high diagnostic value. NLR levels, however, demonstrated greater utility.

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استخدام تركيز نسبة كرات الدم البيضاء متعادلة الصبغة إلى كرات الدم البيضاء الليمفاوية وتركيز حمض البوليك ومتوسط حجم الصفائح الدموية فى تشخيص المبكر للتسمم الدموى بالميكرون لدى حديثى الولادة

الالتهاب البكتيرى فى حديثى الولادة هو أحد الأمراض الأكثر شيوعاً فى الفترة الوليدية ولا يزال سبباً هاماً للمرض والوفيات. يتم تعريف الالتهاب البكتيرى فى حديثى الولادة على أنه متلازمة إكلينيكية فى عمر ٢٨ يوماً من عمر الطفل أو أقل، ويتجلى ذلك من خلال علامات جهازية للعدوى وعزل البكتيريا من مجرى الدم. يمكن تصنيف الالتهاب البكتيرى فى حديثى الولادة وفقاً لوقت البداية كظهور مبكر (أقل من ٣ أيام) أو بداية متأخرة (أكبر من ٣ أيام).

أجريت هذه الدراسة المقطعية العرضية فى حضانات القصر العينى، من يناير إلى أغسطس ٢٠١٨.

كان الهدف من هذه الدراسة هو الكشف عن مسببات الأمراض الشائعة التى تسبب الالتهاب البكتيرى فى حديثى الولادة فى حضانات القصر العينى والكشف عن تأثير الالتهاب البكتيرى فى حديثى الولادة على صورة الدم ومعرفة استخدام تركيز حمض البوليك فى المصل ومتوسط حجم الصفائح الدموية ونسبة كرات الدم البيضاء متعادلة الصبغة إلى كرات الدم البيضاء الليمفاوية فى التشخيص المبكر للتسمم الدموى الميكروبى لدى حديثى الولادة.

شملت الدراسة جميع حديثى الولادة كاملى النمو والخدج، مع تشخيص سريرى و/أو مختبرى للالتهاب البكتيرى. استثنينا حديثى الولادة الذين يعانون من التشوهات الخلقية المتعددة.

وتضمن جمع البيانات أخذ البيانات الديموغرافية وبيانات فترة ما حول الولادة، والتاريخ المرضى للأمهات مع التركيز على عوامل الخطر للالتهاب البكتيرى فى الأطفال حديثى الولادة، وأعراض وعلامات الالتهاب البكتيرى التى تم جمعها من الملاحظات اليومية المكتوبة فى ملف كل مريض، وتم تسجيل المضاعفات والنتائج المختلفة.

اشتملت الدراسة على ٧٠ من حديثى الولادة لديهم التهاب البكتيرى ومقارنتهم مع ٧٠ من حديثى الولادة الأصحاء وثبت أن ٣٥ حالة من حديثى الولادة الذين لديهم التهاب بكتيرى لديهم مزارع دم إيجابية (٥٠٪) مقابل حالة سلبية (٥٠٪)، فى حين أن ٣٤ حالة من أصل ٧٠ حالة من حالات الالتهاب البكتيرى المتأخر لم تنج (٤٨.٦٪).

وفيما يتعلق بتوزيع الميكروبات فى مزارع الدم، كانت أكثر الميكروبات شيوعاً Klebsiella متعددة المقاومة للمضادات (٢٤٪)، ثم Pseudomonas (٧٪).

فى دراستنا، نظام التقييم بصورة الدم المحقق نتائج ٣ إلى ٨ الالتهاب البكتيرى المحتمل والمرجح.

ومن الدراسة نستنتج أنه يمكن استخدام النسبة ما بين كرات الدم البيضاء متعاد لة الصبغة إلى كرات الدم البيضاء الليمفاوية فى التشخيص المبكر للتسمم الدموى الميكروبى لدى حديثى الولادة أظهر حساسية عالية (٧٧.١٪)، خصوصية عالية (٩٤.٣٪) وعالية القيمة التنبؤية السلبية (٩٢.٥٪)، وعالية القيمة التنبؤية الإيجابية (٨١.٨٪) فى الكشف عن الالتهاب البكتيرى بالدم وقد أعطى قيمة إحصائية ذات أهمية P (0.001> value) بالاقتران مع حالات الالتهاب البكتيرى المثبتة بمزارع الدم

ويمكن استخدام متوسط حجم الصفائح الدموية فى التشخيص المبكر للتسمم الدموى الميكروبى لدى حديثى الولادة أظهر حساسية عالية (٨٨٪)، خصوصية عالية (٧.٪)، وعالية القيمة التنبؤية السلبية (٩٤.٩٪)، وعالية القيمة التنبؤية الإيجابية (٥٠٪) فى الكشف عن الالتهاب البكتيرى بالدم وقد أعطى قيمة إحصائية ذات أهمية (p-value <0.001) بالأقتران مع حالات الالتهاب البكتيرى المثبتة بمزارع الدم.

ويمكن استخدام تركيز حمض البوليك فى التشخيص المبكر للتسمم الدموى الميكروبى لدى حديثى الولادة أظهر حساسية عالية (٦٥.٧٪)، خصوصية عالية (٨٥.٧٪)، وعالية القيمة التنبؤية السلبية (٨٨.٢٪)، وعالية القيمة التنبؤية الإيجابية (٦٠.٥٪) فى الكشف عن الالتهاب البكتيرى بالدم وقد أعطى قيمة إحصائية ذات أهمية (p-value <0.001) بالأقتران مع حالات الالتهاب البكتيرى المثبتة بمزارع الدم.

حيث أوضحت الدراسة أن النسبة ما بين كرات الدم البيضاء متعادلة الصبغة إلى كرات الدم البيضاء الليمفاوية فى التشخيص المبكر للتسمم الد موى الميكروبى لدى حديثى الولادة أكثر خصوصية يليه متوسط حجم الصفائح الدموية ثم تر كيز حمض البوليك فى المصل بينما متوسط حجم الصفائح الدموية أكثر حساسية من النسبة ما بين كرات الدم البيضاء متعادلة الصبغة إلى كرات الدم البيضاء الليمفاوية وتر كيز حمض البوليك فى المصل.