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## *D-DIMER AS AN EARLY DIAGNOSTIC MARKER IN NEONATES WITH SEPSIS*

**By**

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### **ABSTRACT**

**Objectives:** To measure D.dimer levels in neonatal sepsis and compare as a marker of sepsis with blood culture and other established marker of sepsis like C.reactive protein, micro. erythrocyte sedimentation rate and total leucocyte count (TLC) in predicting sepsis.

**Study Design:** A case control hospital based study.

**Subjects:** From September 2020 till March 2021. 90 patients with neonatal sepsis selected from neonatal units of Bab-Elsheria university hospital. They were divided in to 3 groups Early onset sepsis (EOS) group (Group A) that include 30 neonates, Late onset sepsis (LOS) group (Group B) that include 30 neonates and control group (Group C) that include 30 healthy neonates.

**Methods:** All neonates, cases and control were investigated at admission. A complete medical history, clinical examination, and diagnostic tests were performed for all newborns (CBC, CRP, blood culture, D-dimer) and simultaneously the D-dimer levels were evaluated in predicting neonatal sepsis and were compared with other established markers of sepsis in predicting sepsis.

**Results:** In the current study, there was no statistical significant difference between groups as regard sex and Residence, but there was statistical significant difference between groups as regard Weight (kg) and Age (day) where  $p < 0.05$ ,  $p < 0.001$  respectively. Group A (Early onset sepsis) included 8 (26.7%) with Negative blood culture and 22(73.3%) had Positive blood culture, Group B (Late onset sepsis) included 3(10%) with Negative blood culture and 27(90%) had Positive blood culture, Group C (control group) included 30 (100 %) with Negative blood culture. There was statistical significant difference between studied groups as regard D dimer and TLC where  $p < 0.05$ , also as regard Micro ESR and CRP where  $p < 0.001$ . From the results of this study, D-dimer has highly statistical significant ability to diagnose septic neonates with sensitivity 70.0%, specificity 60.0%, PPV 77.8%, and NPV 50.0%, as regard CRP; sensitivity was 98.33%, specificity was 100.0%, PPV was 100.0%, and NPV is 96.8% to diagnose neonatal sepsis, then as regard Micro-ESR highly statistical

significant ability to diagnose neonatal sepsis with sensitivity is 78.33%, specificity is 76.67%, PPV is 87.0%, NPP is 63.9%, and TLC at cut of value >11780 has highly statistical significant ability to diagnose neonatal sepsis with sensitivity is 66.67%, specificity is 63.33%, PPV is 78.4%, NPP is 48.7%. D-dimer had the lowest specificity and positive predictive value of 60% and 77.8% respectively amongst the markers studied.

**Conclusion:** Although D-dimer was inferior to CRP&TLC&ESR in predicting neonatal sepsis, it should be measured in neonates with sepsis for early identification of DIC.

**Key words:** D.dimer, sepsis, screen.

## INTRODUCTION

Sepsis is still a critical challenge in pediatric critical care medicine, in spite of continued advances in neonatal medicine (Schüller S et al., 2018). Neonatal sepsis mortality has dropped from 87% in 1928 to 3% in 2003, yet it remains a major cause of illness and mortality in newborns (Stockmann C et al., 2014). Neonatal sepsis is a phrase used to describe a systemic bacterial, viral, or fungal infection that causes hemodynamic abnormalities and other clinical symptoms as well as significant morbidity and death in the newborn population. Severe neonatal sepsis can be characterized as either early or late onset, based on the age and time of the sepsis episode (Wynn J et al., 2014). Neonatal sepsis causes some nonspecific symptoms and signs, involving jaundice, hypnosis, bradycardia, apnea, tachycardia, respiratory distress,

hypotonia, bulging fontanel, feeding difficulties, seizures, long capillary refill time and temperature instability (Bhutani V, Johnson L, 2009).

Neonatal sepsis can only be accurately diagnosed by a blood culture, which is the gold standard in this field. It is possible to miss the causative agent due to technical issues like as poor blood sample or antibiotic use by the mother (Edgar J et al., 2010).

Neonatal sepsis is associated with a high incidence of coagulation malfunction, which might appear clinically or sub clinically in the setting of DIC. When the clotting system is overactive, it leads to an increase in fibrin deposition and a decrease in clotting factor and platelet consumption, which is known as DIC (Ishikura H et al., 2014). Chronic inflammation causes intravascular deposition of fibrin and a prothrombotic condition, which in turn causes

microvascular thrombosis, which in turn causes various organs to be damaged by anoxic injury (Kumar P et al., 2015). When fibrin is broken down, a molecule called D-dimer is created, and this molecule's concentration rises in sepsis as a result of fibrinolysis. D-dimer is also elevated in DIC, which indicates that the coagulation mechanism has been activated (Levi M et al., 2013).

The goal of this work was to evaluate the clinical significance of D-Dimer level for diagnosis of neonatal sepsis and compare as a marker of sepsis with blood culture and other established marker of sepsis like C-reactive protein, micro. Erythrocyte sedimentation rate and total leucocyte count (TLC) in predicting sepsis.

### **SUBJECTS AND MATERIALS**

After approval of the committee of research ethics in pediatric department, faculty of medicine, Al-Azhar university and after taking a written consent from the parents of participants. This study was carried out on 90 neonates admitted at the neonatal units of Bab-Elsheria university hospital by simple random method in a period from September 2020 till March 2021. They were divided in to 3 groups:

- \* **Early onset sepsis (EOS) group (Group A)** that include 30 neonates,
- \* **Late onset sepsis (LOS) group (Group B)** that include 30 neonates and \*Control group (Group C) that include 30 healthy neonates.

All neonates, cases and control who investigated at admission and simultaneously the D-dimer levels was measured, evaluated in predicting neonatal sepsis and compared with other established markers of sepsis in predicting sepsis.

### **Inclusion criteria:**

**Inclusion criteria were:** for Septic neonates according to clinical and lab investigation, full term & preterm both sexes male and female, Early onset neonatal sepsis (less than 72 hours of age) and Late onset sepsis (more than 72 hours of age). For control group, to be non-septic clinically and laboratory.

### **Exclusion criteria:**

**Exclusion criteria were:** Congenital anomalies, Birth asphyxia and surgical problems, IDM, DIC and Pathological jaundice.

**All neonates participating in this study were subjected to the following:**

**History:** The patient's age, sex, gender, maternal risk factors, gestational age, prenatal and natal history were all recorded in a thorough medical history.

**Clinical examination:** Weight of a newborn, Suckling and Moro reflexes (Moro) were performed on the newborns as well as vital parameters such as heart rate and respiration rate. Spotting the early indications of sepsis: Restlessness, sleepiness, pallor, and mottled skin characterise the infant's condition, and a fluctuation in temperature, either hyperthermia or hypothermia and problem with the respiratory system.

**Laboratory evaluation:** When sepsis was suspected, blood samples were collected. Four centimeters of blood were collected by applying antiseptic to the skin. For the CBC, 1 cm of blood was injected into the culture bottle, whereas 2 cm of blood were taken in a simple test tube for the CRP. Complete blood count was analysed by sysmex 21-kx cell counter for hemoglobin level, red blood cell count, RDW, hematocrit value, platelet count

and white blood cell (WBC) count (Total and differential). Results of CBC were interpreted using Hematological scoring system by (Rodwell et al., 1988).

**Quantitative C-reactive protein (CRP):** Turbox plus was used to separate serum after centrifuging for 10 minutes at 1500 rpm with 1cm of blood in a plain test tube. Results were considered positive when they exceeded 6 mg/l.

**Blood culture:** Using automated BACT/ALERT 3D 60 (Biomerieux).

**D-dimer:** D-dimer test was done using automated chemistry analyzer Cobas 6000, Roche diagnostics.

#### **Sample size:**

Based on our pilot study in which was conducted on 10 patients in each group. Mean d.dimer in early sepsis was  $1.8 \pm 0.71$  compared to  $1.37 \pm 0.6$  in control group, so sample size was conducted to be 90 (30 in each group).

Sample size was calculated using Open Epi softwar with confidence level 95% and power 80%.

## RESULTS

In the current study, there was no statistical significant difference between studied groups as regard sex and Residence, but there was statistical significant difference between groups as regard Weight (kg) and Age (day) where  $p < 0.05$ ,  $p < 0.001$  respectively. **Table (1).**

There were high statistical significant differences between each of group A and group B and between group A and group C as regard Age (day), while there was non-statistical significant difference between group B and group C as regard Age (day).

There were statistical significant differences between each of group A and group B and between group A and group C as regard Weight (kg), while there was non-statistical significant difference between group B and group C as regard Weight (kg).

There was statistical significant difference between groups as regard D dimer and TLC where  $p < 0.05$ , also there was high statistical significant difference between groups as regard Micro ESR and CRP where  $p < 0.001$  **Table (2).**

There were statistical significant differences between each of group A and group B, group B and group C as regard D

dimer, while there was no statistical significant difference between group A and group C as regard D dimer.

There were no statistical significant differences between each of group A and group B as regard TLC, while there was statistical significant difference between group A and group C as regard TLC, while there was high statistical significant difference between group B and group C as regard TLC.

There were no statistical significant differences between each of group A and group B as regard Micro ESR, while there was high statistical significant difference between group A and group C & group B and group C as regard Micro ESR.

There were high statistical significant differences between each of group A and group B, between group A and group C & between group B and group C as regard CRP.

The result of this study shows that D-dimer has highly statistical significant ability to diagnose patients, from control with sensitivity 70.0%, specificity 60.0%, PPV 77.8%, and NPV 50.0%, as regard CRP; sensitivity was 98.33%, specificity was 100.0%, PPV was 100.0%, and NPV is 96.8%

to diagnose diseased from control, then as regard Micro-ESR highly statistical significant ability to diagnose patients, from control with sensitivity is 78.33%, specificity is 76.67%, PPV is 87.0%, NPP is 63.9%,

and TLC at cut of value >11780 has highly statistical significant ability to diagnose patients, from control with sensitivity is 66.67%, specificity is 63.33%, PPV is 78.4%, NPP is 48.7%. **Table (3).**

**Table (1): Comparison between the three studied groups according to demographic data**

Demographic data	Group A (n = 30)		Group B (n = 30)		Group C (n = 30)		Test of Sig.	p
	No.	%	No.	%	No.	%		
Sex								
Male	17	56.7	17	56.7	12	40.0	$\chi^2=$ 2.223	0.329
Female	13	43.3	13	43.3	18	60.0		
Age (day)								
Min. – Max.	1.0 – 19.0		15.0 – 57.0		2.0 – 60.0		H= 38.150*	<0.001*
Mean $\pm$ SD.	10.73 $\pm$ 5.43		36.43 $\pm$ 13.53		30.20 $\pm$ 18.68			
Median (IQR)	12.0(6.0 – 16.0)		37.0(20.0 – 48.0)		29.0(14.0 – 49.0)			
& Sig. bet. grps.	p <sub>1</sub> <0.001*, p <sub>2</sub> <0.001*, p <sub>3</sub> =0.105							
Weight (kg)								
Min. – Max.	2.50 – 4.0		2.50 – 5.50		2.60 – 5.40		F= 6.890*	0.002*
Mean $\pm$ SD.	3.28 $\pm$ 0.44		3.89 $\pm$ 0.92		3.92 $\pm$ 0.82			
Median (IQR)	3.30(2.90 – 3.70)		3.75(3.10 – 4.70)		4.0(3.10 – 4.40)			
& Sig. bet. grps.	p <sub>1</sub> =0.006*, p <sub>2</sub> =0.004*, p <sub>3</sub> =0.990							
Residence								
Rural	21	70.0	20	66.7	15	50.0	$\chi^2=$ 2.931	0.231
Urban	9	30.0	10	33.3	15	50.0		

$\chi^2$ : Chi square test, IQR: Inter quartile range. SD: Standard deviation

F: F for ANOVA test, Pairwise comparison bet. each 2 groups was done using Post Hoc Test (Tukey)

H: H for Kruskal Wallis test, Pairwise comparison bet. each 2 groups was done using Post Hoc Test (Dunn's for multiple comparisons test)

p: p value for comparing between the studied groups

$p_1$ : p value for comparing between Group A and Group B

$p_2$ : p value for comparing between Group A and Group C

$p_3$ : p value for comparing between Group B and Group C

\*: Statistically significant at  $p \leq 0.05$

This table shows that there was no statistical significant difference between studied groups as regard sex and Residence, but there was statistical significant difference between groups as regard Weight (kg) and Age (day) where  $p < 0.05$ ,  $p < 0.001$  respectively.

**Table (2): Comparison between the three studied groups according to Lab test.**

Lab test	Group A (n = 30)	Group B (n = 30)	Group C (n = 30)	Test of Sig.	p
D dimer					
Min. – Max.	0.20 – 3.0	0.30 – 5.50	0.20 – 3.20	H= 12.132*	0.002*
Mean ± SD.	1.72 ± 0.93	2.82 ± 1.77	1.34 ± 0.72		
Median (IQR)	1.60(1.0 – 2.70)	2.60(1.10 – 4.70)	1.05(0.80 – 2.0)		
Sig. bet. grps.	p <sub>1</sub> =0.045*, p <sub>2</sub> =0.143, p <sub>3</sub> =0.001*				
TLC					
Min. – Max.	2897.0 – 27166.0	1275.0 – 32501.0	3771.0 – 20926.0	H= 12.710*	0.002*
Mean ± SD.	15544.8 ± 7992.9	18977.5 ± 9548.0	10960.4 ± 5172.1		
Median (IQR)	18146.5 (7619.0– 23439.0)	20819.5 (12214.0– 26321.0)	11129.0 (6109.0– 15804.0)		
Sig. bet. grps.	p <sub>1</sub> =0.147, p <sub>2</sub> =0.036*, p <sub>3</sub> <0.001*				
Micro ESR					
Min. – Max.	0.90 – 7.50	1.60 – 6.10	1.50 – 14.0	F= 23.608*	<0.001*
Mean ± SD.	4.67 ± 1.95	3.81 ± 1.25	7.84 ± 3.44		
Median (IQR)	4.55(3.30 – 6.60)	3.70(2.80 – 4.90)	7.30(5.40 – 10.40)		
Sig. bet. grps.	p <sub>1</sub> =0.347, p <sub>2</sub> <0.001*, p <sub>3</sub> <0.001*				
CRP					
Min. – Max.	5.0 – 69.0	100.0 – 161.0	1.0 – 5.0	H= 79.054*	<0.001*
Mean ± SD.	38.83 ± 21.62	127.1 ± 19.50	2.83 ± 1.39		
Median (IQR)	37.50(21.0 – 56.0)	127.0(111.0– 142.0)	3.0(2.0 – 4.0)		
Sig. bet. grps.	p <sub>1</sub> <0.001*, p <sub>2</sub> <0.001*, p <sub>3</sub> <0.001*				

IQR: Inter quartile range

SD: Standard deviation

F: F for ANOVA test, Pairwise comparison bet. each 2 groups was done using Post Hoc Test (Tukey)

H: H for Kruskal Wallis test, Pairwise comparison bet. each 2 groups was done using Post Hoc Test (Dunn's for multiple comparisons test)

p: p value for comparing between the studied groups

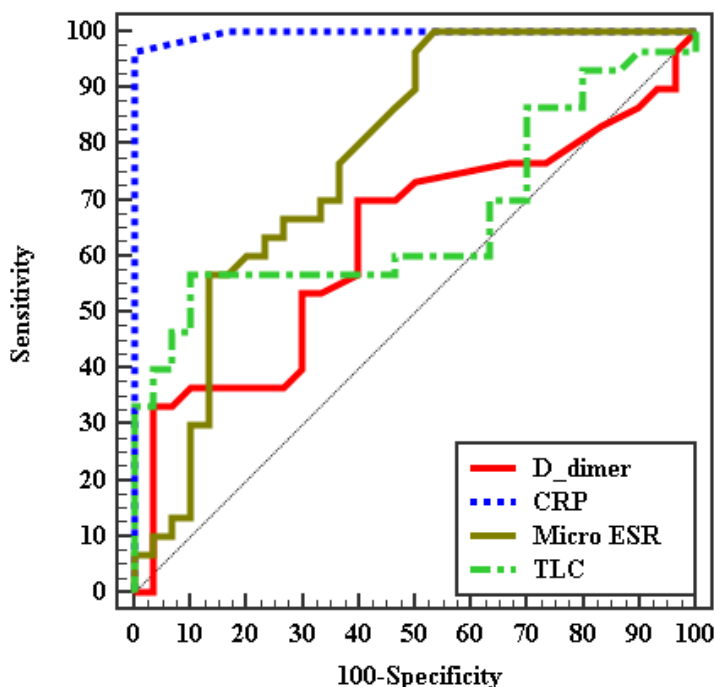
p1: p value for comparing between Group A and Group B

p2: p value for comparing between Group A and Group C

p3: p value for comparing between Group B and Group C

This table shows that there was statistical significant difference between groups as regard D dimer and TLC where

$p < 0.05$ , also there was high statistical significant difference between groups as regard Micro ESR and CRP where  $p < 0.001$



ROC curve for D-dimer, C-reactive protein, micro-erythrocyte sedimentation rate and total leucocyte count (TLC)

for early diagnosis of sepsis in neonates ( $n = 30$ ) from control ( $n = 30$ ).



**Table (3): Agreement (sensitivity, specificity) for D-dimer, C-reactive protein, micro-erythrocyte sedimentation rate and total leucocyte count (TLC) for early diagnosis of sepsis in neonates (n = 30) from control (n = 30)**

	AUC	P	95% C.I	Cut off <sup>#</sup>	Sensitivity	Specificity	PPV	NPV
<b>D-dimer</b>	0.627	0.092	0.482 – 0.772	>1.2	70.0	60.0	63.6	66.7
<b>CRP</b>	0.997	<0.001*	0.990 – 1.005	>5 <sup>#</sup>	96.67	100.0	100.0	96.8
<b>Micro-ESR</b>	0.778	<0.001*	0.658 – 0.898	≤7.4 <sup>#</sup>	96.67	50.0	65.9	93.7
<b>TLC</b>	0.672	0.022*	0.529 – 0.814	>11520	60.0	53.33	56.2	57.1

AUC: Area Under a Curve. p value: Probability value

CI: Confidence Intervals

NPV: Negative predictive value, PPV: Positive predictive value

\*: Statistically significant at  $p \leq 0.05$

<sup>#</sup>Cut off was choose according to Youden index

## DISCUSSION

Early diagnosis of neonatal sepsis continues to pose a problem to the doctors caring for newborns. It is proposed that coagulation dysfunction, one of the many complications of neonatal sepsis is present in around 10% of sick newborn (**Kumar et al., 2015**).

In sepsis, enhanced fibrin formation, impaired fibrin degradation, and intravascular fibrin deposition lead to a prothrombotic state. Fibrin (fibrinogen)-degradation products (FDPs) are protein fragments of various sizes that result from the proteolytic action of plasmin on fibrin or fibrinogen. Plasma levels of these fragments are commonly increased in association with

disseminated intravascular coagulation (DIC) and fibrinogenolysis, disorders in which their presence is of considerable diagnostic significance (**Sharma et al., 2018**).

D-dimer formed on cleavage of cross linked fibrin is a specific marker of fibrinolysis. It is identified in the blood of patients with various thrombotic and thrombolytic disorders. It is reported that levels of D-dimer increase in patients with sepsis due to fibrinolysis. Other causes of increased D-dimer include venous thromboembolism, syncope, heart failure, trauma, and cancer. D-dimer is more specific compared

to FDP, which is more sensitive to detect DIC (**Lippi et al., 2014**).

No one biomarker is likely to adequately reflect the rapidly evolving nature of a potentially septic patient's status, even if monitored frequently during the course of the patient's hospital stay. Biomarkers of sepsis used in this way should probably be implemented as multi-marker panels that include both pro-inflammatory and anti-inflammatory biomarkers (**Faix, 2013**).

In the current study, there was no statistical significant difference between groups as regard sex and Residence, but there was statistical significant difference between groups as regard Weight (kg) where  $p < 0.05$ , also there was high statistical significant difference between groups as regard Age (day) where  $p < 0.001$ .

There were high statistical significant differences between each of group A and group B and between group A and group C as regard Age (day), while there was non-statistical significant difference between group B and group C as regard Age (day).

There were statistical significant differences between each of group A and group B and between group A and group C as regard Weight (kg), while there

was non-statistical significant difference between group B and group C as regard Weight (kg).

In contrast, no significant differences were found in age, gender and weight (**Mahmoud et al., 2020**) and (**Ozdemir et al., 2017**).

From the results of this study, Group A (Early onset sepsis) included 8 (26.7%) with Negative blood culture and 22(73.3%) had Positive blood culture, Group B (Late onset sepsis) included 3(10%) with Negative blood culture and 27(90%) had Positive blood culture, Group C (control group) included 30 (100%) with Negative blood culture.

In contrast, in 56.5% early-onset cases the blood-culture was positive, while in only 21.6% late-onset sepsis cases a pathogen was isolated from blood culture (**Zakariya et al., 2011**).

In our study, there was statistical significant difference between groups as regard D dimer and TLC where  $p < 0.05$ , also there was high statistical significant difference between groups as regard Micro ESR and CRP where  $p < 0.001$ .

There were statistical significant differences between each of group A and group B, group B and group C as regard D

dimer, while there was no statistical significant difference between group A and group C as regard D dimer.

There were no statistical significant differences between each of group A and group B as regard TLC, while there was statistical significant difference between group A and group C as regard TLC, while there was high statistical significant difference between group B and group C as regard TLC.

There were no statistical significant differences between each of group A and group B as regard Micro ESR, while there was high statistical significant difference between group A and group C & group B and group C as regard Micro ESR.

There were high statistical significant differences between each of group A and group B, between group A and group C & between group B and group C as regard CRP.

D-dimer, a specific marker of fibrinolysis was positive in 36 out of 50 (72%) patients. Elevated levels result from activation of coagulation (**Sharma et al., 2018**). **Iskander et al. (2013)** observed D-dimer positivity in 100% of patients with sepsis. **Kim et al, (2007)** also reported D-

dimer positivity in 99.7% of patients with severe sepsis.

In a study conducted on 47 patients with sepsis, 18 with severe sepsis and 17 with septic shock, D-dimer was detected in 49% of patients and was significantly higher than that of the controls (**Ersoy et al., 2007**). The positivity increased further in severe sepsis and septic shock. **Peker et al. (2011)** studied global fibrinolytic capacity in 61 newborn infants and found that D-dimer levels were significantly ( $P<0.05$ ) higher in patients compared with the controls.

In clinical work, various serologic markers such as CRP, WBC counts, lymphocytes, neutrophils are often used to support the diagnosis of sepsis. There was no statistically significant difference between early onset sepsis group and late onset sepsis group regarding the counts of the WBC and CRP value (**Li et al., 2013**) and (**Jean-Baptiste et al., 2011**).

In agreement with our results, there was significant differences as regards total leucocytic count between cases and control (**Mahmoud et al., 2020**) and (**Ozdemir et al., 2017**).

Micro-ESR method is nonspecific and sedimentation is low in the newborn owing to high

hematocrit level, limiting its use as an indicator of sepsis in neonates (Sriram, 2011).

Other studies reported that cases had significant higher level of CRP than control group (Mahmoud et al., 2020) and (Ozdemir et al., 2017). CRP is the most commonly used marker for diagnosis and follow-up of neonatal sepsis. CRP may also show a physiological increase after birth or non-infection-associated conditions. Therefore, there have been concerns about the reliability of CRP during the early stage of the disease being neither able to diagnose nor to rule out an infection with certainty (Hedegaard et al., 2015).

Elgendy et al. (2018) found that there is a significant statistical difference in TLC, Micro ESR and CRP between cases and control while no significant statistical difference between early-onset and late-onset sepsis regarding CRP.

The results demonstrated that there was high statistical significant difference between groups (A&B) as regard SOFA. The Sequential Organ Failure Assessment (SOFA) score is used as a measure of sepsis-associated organ dysfunction. As a consequence, it is reasonable to define the earliest time point

during the course of the disease where a clinical meaningful change of the baseline SOFA score is achieved (Karakike et al., 2019).

From the results of this study, D-dimer has highly statistical significant ability to diagnose patients, from control with sensitivity 70.0%, specificity 60.0%, PPV 77.8%, and NPV 50.0%.

D-dimer values were significantly higher in the study group as compared to the control group. D-dimer had the highest sensitivity of 90.0% among all markers in the sepsis group. it was found that D-dimer is increased in septic neonates as compared to newborns with mild infection (Kumar et al., 2015). Armengou et al. (2008) in his study in foals found that normal D-dimer concentration is better at eliminating the diagnosis of sepsis than an increased D-dimer concentration at predicting sepsis.

In the current study, as regard CRP; sensitivity was 98.33%, specificity was 100.0%, PPV was 100.0%, and NPV is 96.8% to diagnose diseased from control, then as regard Micro-ESR highly statistical significant ability to diagnose patients, from control with sensitivity is 78.33%, specificity is 76.67%, PPV is

87.0%, NPP is 63.9%, and TLC at cut of value >11780 has highly statistical significant ability to diagnose patients, from control with sensitivity is 66.67%, specificity is 63.33%, PPV is 78.4%, NPP is 48.7%.

This is disagreeing with results of previous study where positive predictive value and specificity of TLC in neonatal sepsis was highest (82.8% and 90.7% respectively). Micro-erythrocyte sedimentation rate (MicroESR) in the study was found to have highest negative predictive value in sepsis. C-reactive protein (CRP) was reasonably fair marker of sepsis on various parameters like positive and negative predictivity, sensitivity and specificity (**Kumar et al., 2015**).

D-dimer had the lowest specificity and positive predictive value of 60% and 77.8% respectively amongst the markers studied. In accordance with the current study, Kumar et al. (2015) study found that D-dimer also had the lowest specificity and positive predictive value of 58.3% and 69.4% respectively amongst the markers studied.

D-dimer has highly statistical significant ability for early diagnosis of sepsis in neonates from control with sensitivity 70.0%, specificity 60.0%, PPV

63.6%, and NPV 66.7%, as regard CRP; sensitivity was 96.67%, specificity was 100.0%, PPV was 100.0%, and NPV is 96.8% to diagnose diseased from control, then as regard Micro-ESR highly statistical significant ability for early diagnosis of sepsis in neonates from control with sensitivity is 96.67%, specificity is 50.0%, PPV is 65.9%, NPP is 93.7%, and TLC at cut of value >11520 has highly statistical significant ability to diagnose patients, from control with sensitivity is 60.0%, specificity is 53.33%, PPV is 56.2%, NPP is 57.1%.

## CONCLUSION

Although D-dimer was inferior to CRP in predicting neonatal sepsis, in addition to its established role in coagulation disturbances. It might be used as a marker in neonatal sepsis. D-dimer increased with increased severity of cases who had bad prognosis, so it can be used for prognostic purposes in neonatal sepsis or early prediction of severe sepsis rather than the early diagnosis of neonatal sepsis. D-dimer should be measured in children with sepsis for early identification of DIC.

## **RECOMMENDATION**

Further studies on large geographical scale and on larger sample size to emphasize our conclusion.

The high positivity for D-dimer suggested that it should be measured in children with sepsis for early identification of DIC. This aids better management since additional coagulation based therapy such as recombinant anti-thrombin and thrombomodulin may help to improve prognosis.

It is recommended to do Further studies with larger number of cases and more study parameters are to be included to investigate the etiology and outcome of neonatal sepsis.

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