NEUTROPHIL GELATINASE-ASSOCIATED LIPOCALIN LEVEL IN THE BLOOD AS A PREDICTOR OF EARLY AND LATE ONSET NEONATAL SEPSIS

Manal Mohamed Zaher*; Soma Abd Allah Mohamed*; Nagwa Abdel Ghaffar Mohamed; Ali Abdelaziz Ali*** and Raghda Hussien Abd Allah******

*Pediatric Department Faculty of Medicine for Girls al Azhar University
** Clinical and Chemical Pathology National Research Center
*** Pediatric Department National Research Center
**** Pediatric Department polak general hospital

ABSTRACT

Objective: The aim of this study is to assess the blood neutrophil gelatinase-associated lipocalin (NGAL) level in septic newborns and its role as early biomarker in neonatal sepsis. ***Subject and Methods***: The study group consisted of forty neonates was diagnosed as neonatal sepsis and the control group included twenty newborns. Inclusion criteria were formerly sought in our subjects who were diagnosed using the clinical signs and laboratory findings of sepsis. The results of white blood cell and platelet counts, immature/total neutrophil ratio, CRP and NGAL values were evaluated in both groups. Enzyme linked zorbant immunoassay methods were used to determine the NGAL levels. **Results:** The mean NGAL level was found to be 174.42 ± 56.54, 249.44 ± 88.69, 56.04 ± 7.10 ng/ml in patients with early onset, late onset neonatal sepsis and in healthy subjects respectively ($p<0.001$). When the NGAL levels were compared between both groups, the specificity was 95%, sensitivity was 95%, negative estimation value was 86.4% and positive estimation value was 97.4%.and cut off level 88 ng/ml. **Conclusion:** these findings indicate that NGAL level is a good early indicator for the diagnosis of nenatal sepsis.

KEY WORDS: **EARLY DIAGNOSIS, NGAL, SEPSIS.**

INTRODUCTION

Neonatal sepsis is recognized as one of the most severe pathologies in newborns and young infants ***(1)***, responsible for almost one and a half million deaths each year, worldwide **,** rates of sepsis Up to 10% of infants have infections in the first month of life, the matter which results in 30-50% of total neonatal deaths in developing countries ***(2,)*** and it is considered the single most important cause of death ***(3)*** accounting for up to 50% of neonatal mortality ***(4).***

Neutrophil Gelatinase-Associated Lipocalin (NGAL) is a 25-kDa protein expressed in neutrophils, lung, gastrointestinal tract, and kidney ***(5).*** It is expressed dramatically when epithelial organs undergo signaling, which is usually associated with cell damage, including ischemia-reperfusion injury, the presence of cytotoxins and sepsis ***(6).*** Increased NGAL values is more accurately reflect the severity of inflammatory status ***(1).*** When sepsis was first suspected, NGAL was up regulated directly by bacterial products themselves or by circulating inflammatory mediators ***(5,7)***

Diagnosis of sepsis in neonates is nearly difficult to be confirmed early ***(5).*** So we need faster method to detect sepsis earlier than blood culture.

AIM OF THE WORK

The aim of this study is to assess the blood Neutrophil gelatinase-associated lipocalin (NGAL) level in septic newborns and its role as early biomarker in neonatal sepsis.

SUBJECTS AND METHODS

Study design: It is a case control comparative study.

Study setting: All cases were taken from the neonatal intensive care unit in Al-Zahraa hospital after approval of its ethical committee from April 2014 till September 2014.

Study population and methods: The study was carried out on 60 full term neonates divided into 3 groups: group I (n=20): full term neonates with early onset neonatal sepsis(<72 h) ,group II (n=20): full term neonates with late onset neonatal sepsis (>72 h),group III (n=20): control group: apparently healthy full term neonates, age and sex matched.

Inclusion criteria:

- Age: full term neonates from 0-28 days of both sex.

- Neonates with early and late onset sepsis: the clinical signs for diagnosis of neonatal sepsis including any of the following signs; respiratory rate > 60 breaths/min (tachypnea), grunting, temperature >37.7°C or <35.5°C (hypothermia), lethargic or unconscious, not able to sustain sucking, tachycardia, and convulsion ***(2)***

Exclusion criteria: Neonates with major congenital anomalies or associated syndromes. All cases with different clinical presentations resembling neonatal sepsis (perinatal asphyxia, hypoxic ischemic encephalopathy (HIE), necrotizing enterocolitis, transient tachypnea of the newborn etc…).

All neonates in the study were subjected to the following:

Thorough history taking: Maternal risk factors of sepsis as (offensive liquor, premature rupture of membranes (PROM) >18hrs, maternal fever >38°C, and maternal UTI), Mode of delivery. Apgar score,. symptoms of sepsis

Careful clinical examination: Gestational age assessment using new Ballard score ***(8).*** Anthropometric measures (weight, length, head circumference).Detection of 3 or more clinical signs of sepsis according to ***(2).***

Laboratory investigations including:

1-Complete blood count:

2- C-reactive protein:

3- NGAL level determination:

Collection of blood samples:

Six ml of venous blood samples were collected from each neonate participating in the study and divided into 3 parts: The 1st part was 2 ml of blood collected on ice in an EDTA containing tubes. CBC was determined immediately. Within 20 minutes after blood sampling, the plasma was separated by centrifugation at1500 xg at 4°C for 15 min. The plasma was removed and transferred to fresh polypropylene tube. Be careful to not disturb white cells in the buffy coat. The transferred plasma was recentrifuged in order to avoid contamination with white blood cells at 1500 x g at 4°C for 15 minutes. The plasma was stored at -20°C for NGAL determination.

The 2nd part was 2 ml of blood and was left to clot then the serum was separated by centrifugation at 1500 xg for 15 minutes for determination of CRP latex agglutination assay using the AVITEX CRP supplied by (Omega Diagnostics Group PLC and Omega Diagnostics Ltd Scotland, UK) ***(9).***

The 3rd part was 2 ml of blood injected in the blood culture bottle for Bactec microbial detection system (Bactec 9050, Becton-Dickinson Company,1 Becton Drive, Franklin Lakes, New Jersey). This is a closed automated system that uses a chemical sensor to detect increases in carbon dioxide production produced by the growth of microorganisms. The sensor is monitored every 10 minutes for increased fluorescence, which is proportional to the amount of carbon dioxide present ***(10)*** Subcultures were done (from positive blood cultures) on blood, chocolate and Mac Conkey agar and the plates were incubated aerobically at 35-37°C for 24 hours. Gram stained film films from bottles with sign of growth were done then direct

biochemical and direct sensitivity were done. Final subcultures were done after seven days for negative blood culture bottles before final reports.

CBC was determined on Coulter Counter T890 (Coulter Counter, Harpenden, UK). Immature neutrophil count was determined by multiplying the percentage of bands, metamyelocyte, myelocytes by the absolute neutrophil count. Immature to total neutrophil ratio (I/T) was calculated as: (Bands + metamyelocyte + myelocytes)/ (segmented neutrophil + bands + metamyelocyte + myelocytes).

Plasma NGAL was determined using sandwich enzyme immuno-assay (11) and the kit was supplied from Bio Vander Gmb (Im Neuenheimer Feld 583, D-69120, Heidelberg, Germany).

Statistical Analysis

Data were collected, coded, revised and entered to the Statistical Package for Social Science (IBM SPSS) version 20. The data were presented as number and percentages for the qualitative data and mean, standard deviations and ranges for the quantitative data. ***Chi square test*** was used in the comparison between two groups with qualitative data and ***Fisher exact test*** was used instead of the Chi-square test when the expected count in any cell found less than 5.

Independent t-test was used in the comparison between two groups with quantitative data and parametric distribution. The comparison between more than two groups with quantitative data and parametric distribution were done by using ***One Way Analysis of Variance (ANOVA) test*** while ***Kruskall-Wallis test*** was used to compare between more than two groups with quantitative data and non parametric distribution. ***Spearman correlation coefficients*** were used to assess the significant relation between two quantitative parameters in the same group. ***Receiver Operating Characteristic curve (ROC)*** was used to assess the best cut off point between two groups with its sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and area under the curve (AUC). The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following: $P > 0.05$: Non significant (NS), $P < 0.05$: Significant (S), $P < 0.01$: Highly significant (HS).

RESULTS

Results illustrated in the following tables and figures.

Table (1): Descriptive data of demographic and clinical findings among patient groups.

			EOS	LOS group	Control group
			No. = 20	**No. = 20**	**No. = 20**
Gender [no. (%)]		Female	7 (35.0%)	6 (30.0%)	9 (45.0%)
		Male	13 (65.0%)	14 (70.0%)	11 (55.0%)
Gestational age(weeks)		Mean±SD	36.95±0.83	37.25±0.91	38±0.86
		Range	36 – 38	36 - 39	36 – 40
Birth weight(kg)		Mean±SD	2.87 ± 0.36	2.62 ± 0.33	3.22 ± 0.35
		Range	2.2 – 3.4	2 – 3	2.7 – 4
Maternal history	UTI	Negative	10 (50.0%)	9 (45.0%)	18 (90.0%)
		Positive	10 (50.0%)	11 (55.0%)	2 (10.0%)
	PROM(>18h)	Negative	20 (100.0%)	20 (100.0%)	20 (100.0%)
		Positive	0 (0.0%)	0 (0 .0%)	0 (0.0%)
	Chorioamnionitis	Negative	20 (100.0%)	20 (100.0%)	20 (100.0%)
		Positive	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Mode of delivery	CS	6 (30%)	4 (20%)	9 (45%)
		NVD	14 (70%)	16 (80%)	11 (55%)
APGAR Score	1MIN	Median (IQR)	5 (4-5)	5 (4-5)	6 (5.5-6)
		Range	3-5	3-5	5-7
	5 MIN	Median (IQR)	7 (7-8)	7 (6.5-8)	8 (8-9)
		Range	5-8	5-8	8-9

This table shows male gender, UTI, PROM, NVD predominance and low B.W among studied groups.

Table (2): Comparison between all studied groups as regards birth weight.

		EOS	LOS group	Control group	Chi-square Test		Sign.
		No. = 20	**No. = 20**	**No. = 20**	**X^2**	**P-value**	
Birth weight(kg)	Mean±SD	2.87 ± 0.36	2.62 ± 0.33	3.22 ± 0.35	50.308	0.000	HS
	Range	2.2 – 3.4	2 – 3	2.7 – 4			

NS: non significant, HS: high significant

This table shows highly statistical significant decrease in body weight among patient groups. However, there was no significant difference between EOS, LOS and control groups in terms of gender.

Table (3): Comparison between EOS, LOS and control groups as regards clinical data.

			EOS	LOS group	Control group	One Way ANOVA		Sign.
			No. = 20	No. = 20	No. = 20	F	P-value	
Apgar score	Apgar 1 min	Median(IQR)	5 (4-5)	5 (4-5)	6 (5.5-6)	33.163*	0.000	HS
		Range	3-5	3-5	5-7			
	Apgar 5 min	Median(IQR)	7 (7-8)	7 (6.5-8)	8 (8-9)	23.807*	0.000	HS
		Range	5-8	5-8	8-9			
Maternal history	UTI	Negative	20 (100%)	20 (100%)	20 (100.0%)	10.294	0.006	HS
		Positive	0 (0%)	0 (0%)	0 (0.0%)			
	PROM (>18 hour)	Negative	20 (100.%)	20 (100%)	19 (95.0%)	15.417	0.000	HS
		Positive	0 (0%)	0 (0%)	1 (5.0%)			

* Kruskal Wallis Test

This table shows that APGAR scores at 1 and 5 minutes were of high significant value as they were significantly lower in EOS and LOS than control group (P value < 0.001), and the same for the premature rupture of membranes and maternal urinary tract infection (P value <0.001).

Table (4): Comparison between all studied groups regarding laboratory data.

		EOS	LOS group	Control group	One Way ANOVA		
		No. = 20	No. = 20	No. = 20	F	P-value	Sign.
TLC(10^3/mm3)	Mean±SD	15.55 ± 6.16	15.21 ± 5.88	6.89 ±1.98	18.869	0.000	HS
	Range	5.8 – 29.6	6.2 – 23.4	4 – 11			
HB**(g/dL)**	Mean±SD	13.04 ± 2.31	11.19 ± 2.77	13.57 ± 2.18	5.246	0.008	HS
	Range	8.9 – 17	7.9 – 17	10.9 – 18			
PLT(/mm3)	Mean±SD	184.55 ± 58.83	176.30 ± 64.54	289.50 ± 71.84	18.689	0.000	HS
	Range	110 – 315	100 – 350	165 – 398			
I/T ratio	Mean±SD	0.21 ± 0.06	0.25 ± 0.09	0.16 ± 0.09	5.833	0.005	S
	Range	0.11 - 0.33	0.12 – 0.5	0.1 – 0.5			

This table show that there was high significant increase in TLC, and I/T ratio (p value < 0.001), and significant decrease in PLT and HB (p value < 0.05) among the studied septic neonates.

Table (5): Comparison between plasma NGAL level among all studied groups.

NGAL(ng/ml)	EOS	LOS group	Control group	One Way ANOVA		
	No. = 20	No. = 20	No. = 20	F	P-value	Sign.
Mean±SD	174.42 ± 56.54	249.44 ± 88.69	56.04 ± 7.10	51.331	0.000	HS
Range	77.2 – 245.9	94.3 – 361.2	43.4 – 65.2			

This table shows that there was high significant increase in NGAL between all studied groups as (p value < 0.001).

Table (6): Comparison between NGAL level among the EOS and LOS groups.

NGAL(ng/ml)	EOS	LOS group	Independent t-test		
	No. = 20	No. = 20	T	P-value	Sign.
Mean±SD	174.42 ± 56.54	249.44 ± 88.69	3.190	0.003	S
Range	77.2 – 245.9	94.3 – 361.2			

This table shows significant increase in plasma NGAL in LOS group when compared to EOS group.

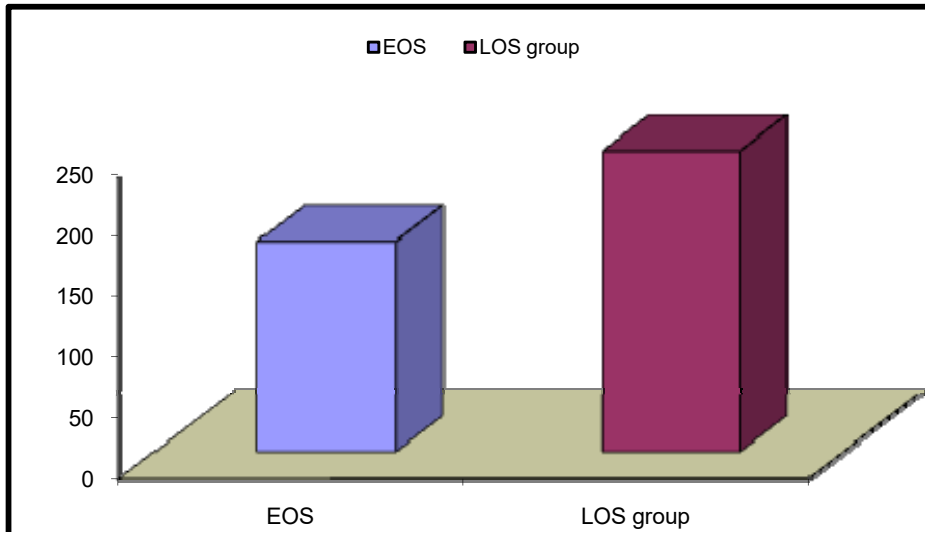

Figure (1): Comparison between plasma NGAL level among the EOS and LOS groups.

Table (7): Correlation between plasma NGAL level and both gestational age and birth weight.

	NGAL(ng/ml)					
	EOS(n=20)		LOS(n=20)		Control(n=20)	
	R	p-value	r	p-value	R	p-value
Gestational age(weeks)	0.552*	0.012	0.205	0.387	0.041	0.864
Birth weight(kg)	0.398	0.083	0.298	0.203	-0.280	0.231

There was positive significant correlation between gestational age and plasma NGAL level in EOS group.

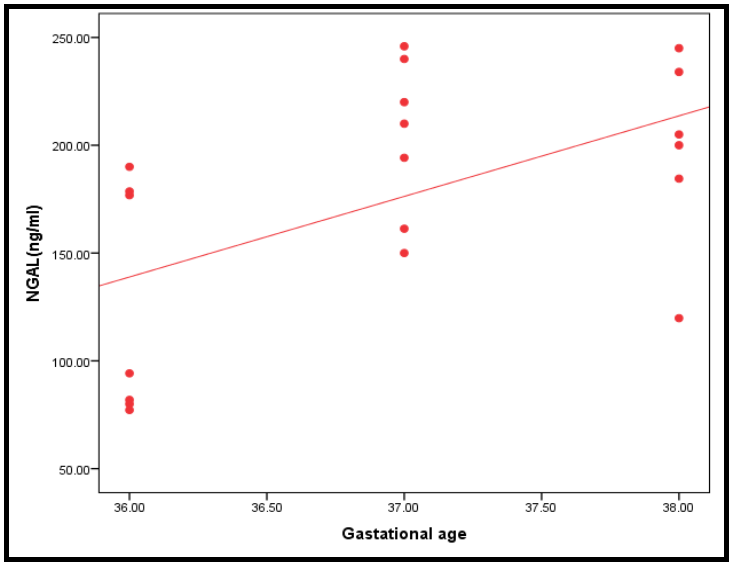

Figure (2): Positive significant correlation between gestational age and plasma NGAL level in EOS group.

Table (8): ROC curve of plasma NGAL level as a diagnostic marker for sepsis.

Cut off point	AUC	Sensitivity	Specificity	+PV	-PV
>88	92.50	95.00	95.00	97.4	86.4

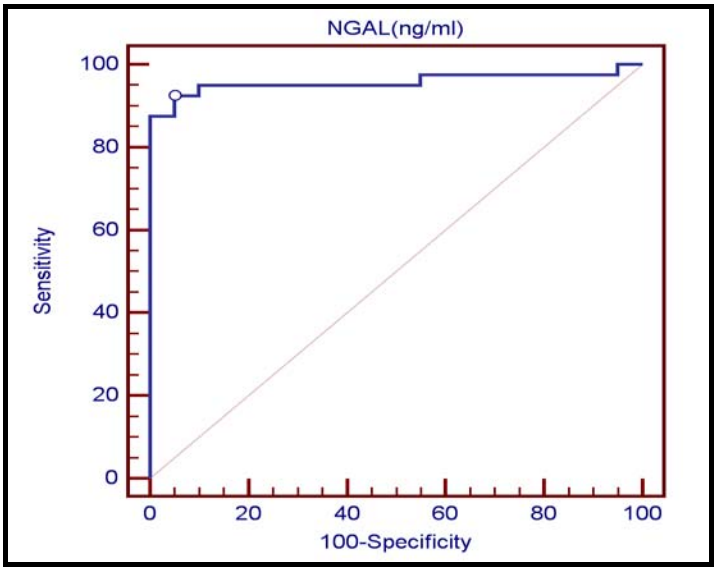

Figure (3): ROC curve of plasma NGAL level as a diagnostic marker for sepsis.

Roc curve show the best cut off point of plasma level is >88ng/ml with both sensitivity and specificity (95%).

DISCUSSION

The level of NGAL in plasma or serum has been proposed as a marker of infection. It acts as a potent bacteriostatic agent and represents a novel and important iron-depleting antimicrobial defense strategy ***(12).***

In the current study, there was highly significant elevation of plasma NGAL level among studied patient groups when compared to control group (p=0.000) which coincide with ***(13,14)*** who concluded that the release of plasma NGAL is not increased in healthy term newborns at birth, but that neutrophils from newborns, even premature infants, are capable of rapidly releasing of plasma NGAL upon bacterial or fungal stimulation in vivo. ***In addition (15),*** reported that plasma NGAL is elevated with sepsis.

In a previous study of***(16),*** over 650 patients presenting to an inner city emergency department, sepsis produced the highest levels of urinary NGAL especially when it was associated with a reduced GFR. While (***17)*** found no difference in NGAL levels between infected and non-infected newborns.

In this study, plasma NGAL was not correlated with gestational age and birth weight in the three groups. Which coincide with ***(14,17)*** who found also no correlation between NGAL and birth weight or gestational age.

In this study, gender showed no influence on plasma NGAL levels. Which agree with ***(18)*** who reported that variations in sex, gestational age and postnatal age, although present, are probably clinically unimportant in the level of NGAL.

Among this study, there was high sensitivity and specificity of Plasma NGAL (95%, 95% respectively) with cut-off value of 88ng/mL, which nearly coincide with previous results have done by**.** ***(14)*** whoreported a sensitivity of 92% and specificity of 91%. Which signifies that plasma NGAL is sensitive and specific marker of neonatal sepsis and highly upregulated in a variety of cells when these are cells engaged in an inflammatory processes ***(19,20),*** and It might be useful as an early marker of nosocomial neonatal infection ***(13),*** and its early detection would help the clinician in early and accurate diagnosis as well as in early initiation of appropriate therapy.

The study revealed that, sex distribution was comparable in patient groups. The early onset sepsis group contained 13 males (65%) and 7 females (35%), the late onset sepsis group contained 14 males (70%) and 6 females (30%).

There was male predominance among studied septic groups which coincide with***(21,22,23,24)*** who found that Male neonates have higher incidence of sepsis than female neonates. In contrary (***25,26)*** found no statistically difference between sepsis and neonatal infection in terms of sex distribution and also in the study of ***(27)*** who had conducted their study on 1743 newborns and found that the rates of infection were similar in males and females. The difference in their results may be related to racial or genetic differences between populations. This suggests the probability of sex linked factor in host susceptibility. The synthesis of gamma globulins is probably regulated by X–linked immuno-regulatory genes and as males are having one X chromosome, they are more prone for neonatal septicemia than female ***(24)***

In the current study it was found that in EOS group body weight was (2.2-3.4kg), mean 2.87±0.36 kg, in LOS group body weight was (2-3kg), mean 2.62±0.33kg, while in control group body weight was (2.74kg), mean 3.22±0.35kg. the

study revealed that there was highly significant decrease in body weight among patient groups (EOS, LOS) when compared to control group (p=0.000), which coincide with the study of(***27)*** and ***(28)*** who found that low birth weight was associated with higher risk for sepsis ***(29).***

This study show UTI in EOS 10(50%), LOS 11(55%), it was found that the septic group has highly significant increase in maternal UTI when compared to control group which coincide with (***27)*** who reported that there is a significant association of neonatal sepsis with maternal UTI. Urinary tract infection (UTI) of any cause raises the risk of sepsis in the neonate due to raising the risk of chorioamnionitis ***(23).***

Among this study, there was (60%), (55%) of mothers have positive history of PROM > 18hrs in EOS and LOS groups respectively with high significant increase when compared to control group (p=0.000). These results agree with the study of **(23,30,31,32,33,34),** who stated PROM >18hrs and chorioamnionitis as risk factors for early onset neonatal sepsis. Moreover, ***(35,36,37)*** reported that prolonged PROM was present in 46% and maternal infection 20% of septic cases. This higher incidence of prolonged PROM may be due to low socioeconomic state and lack of antenatal care of the mothers. When membranes have ruptured prematurely before 37 weeks' gestation, a longer latent period precedes vaginal delivery, increasing the likelihood that the infant will be infected ***(38).***

In the current study, it was found that Apgar scores at 1 and 5 minutes were highly significantly lower in both EOS and LOS groups than in the control group (p=0.000), which coincide with the study of (***39)***, who observed that, a 5-minute Apgar score < 7 carries a significantly higher risk of sepsis than infants with higher scores and that Apgar score less than 5 at one minute may be due to sepsis, especially with the presence of risk factors for infection. Furthermore, low Apgar scores usually necessitate more prolonged and aggressive resuscitation which is a known risk factor for sepsis (***40).*** In contrary, (***41)*** mentioned that Apgar score at 1 and 5 minutes did not show any significant difference in patients with confirmed sepsis versus patients with no infection.

Although white blood cell (WBC) counts and ratios are more sensitive for determining sepsis than platelet counts are, they remain very nonspecific and have a low positive predictive value ***(38)***

In this study, TLC was highly significantly increase in both EOS

and LOS group when combared to control groups (p=0.000) which comes in agreement with (***36,42,43,44,45)*** but not agree with (***46,47,48)*** who didn't found any significant difference in patients with confirmed sepsis versus patients with no infection among their studies. this is may be due to Infants who are not infected may also demonstrate abnormal WBC counts related to the stress of delivery or to any other factors ***(49).***

Thrombocytopenia may be a presenting sign of neonatal sepsis and can last as long as 3 weeks; 10-60% of infants with sepsis have thrombocytopenia ***(50).***

In the current study platelets counts were highly significant lower in EOS and LOS group than control group (P value < 0.001) .Similar findings were reported by (***17, 51)*** who found thrombocytopenia in 76.92% of cases. Thrombocytopenia may occur in neonatal sepsis in response to the cellular products of the microorganisms. These products cause platelet clumping and adherence leading to platelet destruction ***(52).*** In contrary, (***53)*** found that neonatal thrombocytopenia has been estimated to be approximately 20% to 30% of all sick neonates admitted to NICU. Because of the different causes of thrombocytopenia and its late appearance in neonatal sepsis, the presence of thrombocytopenia does not aid the diagnosis of neonatal sepsis ***(54).***

(I/T) neutrophil ratio is believed by many as a single most helpful test available for diagnosing neonatal sepsis ***(54,43,55)*** When diagnosing sepsis, the elevated (I/T) ratio should be used in combination with other signs. This is attributed to the release of neutrophils from bone narrow in response to infection, with increasing number of immature cells entering the blood stream and producing a differential cell count with a shift to the left ***(56).*** The maximum acceptable I/T ratio for excluding sepsis in the first 24 hours is 0.16 ***(38).***

In the current study, immature neutrophil / total (I/T) ratio was significantly increase among patients group when compared to control group (p=0.005), which agree with ***(45)*** who mentioned that I/T ratio, showed statistically significant differences between septic group and control group. In contrary, (***41,57)*** found no statistical differences between patients with confirmed sepsis versus patients with no infection as regards (I/T) ratio. Variations in the results shown by different studies may be due to differences in blood sampling time, severity of infection, the age of neonates and reduced sensitivity of these tests in the first week of life

(57). Or it may be due to that neutropenia is a nonspecific finding, associated with maternal hypertension, perinatal asphyxia and intraventricular hemorrhage. Typically the neutropenia of the infection does not persist for more than 36 hours, whereas the neutropenia observed with noninfectious condition may persist for several days. Neutrophilia may be associated with maternal fever or hemolytic disease of newborn *(58).*

In conclusion: plasma NGAL is sensitive and specific marker for detection of early and late neonatal sepsis, with sensitivity 95% and specificity 95%, so its estimation in clinical suspicion of neonatal sepsis is important for early diagnosis and management of neonatal sepsis to reduce morbidity and mortality of septic newborn.

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مستوى الليبوكالين المصاحب للخلايا البيضاء في الدم كمؤشر للتسمم الدموي المبكر والمتأخر في الأطفال حديثي الولادة

يعد التسمم الدموي أحد أهم وأخطر الأمراض التي تصيب الأطفال حديثي الولادة، وهو السبب الأساسي للوفاة في الأطفال حديثي الولادة.

الليبوكالين المصاحب لخلايا البيضاء هو بروتين يظهر على سطح الخلايا البيضاء والخلايا الطلائية لكل من الرئة، الجهاز الهضمي والكليتين. يظهر الليبوكالين المصاحب لخلايا البيضاء بشدة عندما تعطي خلايا هذه الأعضاء سلسله من الإشارات وتكون غالباً مصاحبة لتلف في الخلايا، وهذا قد يكون نتيجة نقص تدفق الدموي للخلايا أو وجود سموم أو عدوى بكتيرية.

الهدف من الدراسة:

الهدف من هذه الدراسة هو قياس مستوى الليبوكالين المصاحب للخلايا البيضاء بالدم وتقييم دوره كمؤشر مكبر لتسمم الدم المبكر والمتأخر في الأطفال حديثي الولادة.

تشمل هذه الدراسة 60 طفل حديثي الولادة وتم تقسيمهم إلى ثلاثة مجموعات:

- المجموعة الأولى (20 طفل): الأطفال حديثي الولادة المصابون بالتسمم الدموي المبكر أقل من 72 ساعة وتحتوي على 13 ذكر و 7 إناث بمتوسط عمر رحمي 0.83±36.95 ومتوسط وزن 0.36±2.87.
- المجموعة الثانية (20 طفل): الأطفال حديثي الولادة المصابون بالتسمم الدموي المتأخر أكثر من 72 ساعة. تحتوي على 14 ذكر و 6 أنثى بمتوسط عمر رحمي 0.91±37.25 ومتوسط وزن 0.33+2.62.
- المجموعة الثالثة (20 طفل): المجموعة المحددة، الأطفال الأصحاء تحتوي على 11 ذكر و 14 أنثى بمتوسط عمر رحمي 0.86±38 ومتوسط وزن 0.35±3.22.

وقد خضعت كل الأطفال حديثي الولادة التي اشتملت عليهم الدراسة إلى الآتي:

1- دراسة تاريخية كاملة وتشمل:

التاريخ المرضى للام قبل وأثناء الحمل والولادة مثل (ارتفاع درجة الحرارة أكثر من 38 درجة أو انفجار مبكر للكيس المحتوي على الجنين داخل الرحم أو الالتهاب بمجرى البول) طريقة الولادة (ولادة طبيعية او قيصرية).

أعراض التسمم الدموي وتشمل: اضطراب في التنفس وضربات القلب ودرجة الحرارة وتشنجات ونقص في الحركة وضعف الرضاعة.

2- فحص إكلينكي شامل ويشمل:

- تحديد العمر الرحمي للجنين.
- الوزن والطول ومحيط الرأس.
- تحديد علامات التسمم الدموي وتشمل: اضطراب في التنفس وضربات القلب ودرجة الحرارة وتشنجات ونقص في الحركة وضعف الرضاعة.

3- التحاليل الآتية:

- صورة دم كاملة.
- قياس نسبة البروتين التفاعلي "سي" في الدم.
- مزرعة دم.
- اشعة سينية على الصدر.
- قياس نسبة الليبوكالين المصاحب للخلايا البيضاء في البلازما.

نتائج البحث:

من خلال دراستنا، كان مستوى الليبوكالين أعلى بشكل ملحوظ في المجموعة المصابة بالتسمم الدموي المبكر والمتأخر أكثر من المجموعة غير المصابة (المحددة).

وأيضاً، تم التوصل إلى عدم وجود علاقات ارتباط ذات دلالة إحصائية بين مستوى الليبوكالين المصاحب للخلايا البيضاء بالبلازما والوزن عند الولادة والنوع في مجموعتي الأطفال حديثي الولادة المصابين بالتسمم الدموي.

أيضاً، لم يتم التوصل إلى وجود علاقات ارتباط دلالة إحصائية بين مستوى الليبوكالين ببلازما الدم ومستوى ونسبة خلايا النيوتروفيل الغير مكتملة النمو إلى المكتملة النمو وقياس الصفائح الدموية ومجموع عدد الكريات البيضاء وقياس نسبة الهيموجلوبين في مجموعتي الأطفال حديثي الولادة المصابين بالتسمم الدموي.

توصلت دراستنا أيضا على وجود فروق دالة إحصائياً فيما يتعلق بمستوى الليبوكالين المصاحب للخلايا البيضاء الدم بين البداية المبكرة والمتأخرة للمرضى المصابين بالتسمم الدموي.

أظهرت الدراسة الحالية أن أفضل قيمة للقطع بالنسبة لمستوى الليبوكالين ببلازما الدم كمؤشر للكشف المبكر عن التسمم الدموي في الأطفال حديثي الولادة تبلغ (88 نانوجرام/ مليليتر) مع حساسية تبلغ 95% ونوعية تبلغ 95%.

الخلاصة:

- ارتفاع عالي في مستوى الليبوكالين بالبلازما وافضل قيمة للقطع كمؤشر للكشف المبكر عن التسمم الدموي في الأطفال حديثي الولادة تبلغ (88 نانوجرام/مليليتر).

- الليبوكالين بالبلازما مؤشر حساس ونوعي للكشف المبكر عن التسمم الدموي في الأطفال حديثي الولادة) مع حساسية تبلغ 95% ونوعية تبلغ 95%. وقياسه مهم عند الشك في وجود تسمم دموي للتشخيص والعلاج المبكر وتقليل معدل المرض والوفيات في الأطفال حديثي الولادة.

- لا يوجد علاقة ارتباط ذات دلالة إحصائية بين مستوى الليبوكالين بالبلازما والوزن عند الولادة والنوع في مجموعتي الأطفال حديثي الولادة المصابين بالتسمم الدموي.

- توجد علاقة ارتباط ذات دلالة إحصائية بين مستوى الليبوكالين بالبلازما والعمر الرحمي في المجموعة المصابة بالتسمم الدموي المبكر.

التوصيات:

- يمكن استخدام الليبوكالين بالبلازما كمؤشر للكشف المبكر عن التسمم الدموي في الأطفال حديثي الولادة نتيجة حساسيته ونوعيته لتقليل معدل المرض والوفيات في الأطفال حديثي الولادة.

- عمل دراسات بشكل موسع لتحديد قيمة قياس الليبوكالين بالبلازما كمؤشر للكشف المبكر عن التسمم الدموي في الأطفال حديثي الولادة.

- عمل دراسات بشكل موسع لمعرفة أن كان مستوى الليبوكالين بالبلازما يتأثر بوجود أمراض أخرى في الأطفال مثل مرض اضطراب التنفس وأمراض النزيف الدموي أو حالات الجراحة المختلفة.