Diagnostic Performance of Neutrophil CD64 as an Early Predictor of Postoperative Sepsis

Original Article

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ABSTRACT

Background: Sepsis is a serious impaired organ function as a result of immune dysregulation for infection. Blood culture is considered the gold standard for diagnosis of blood-stream infections, but it can be delayed up to 7 days to give a negative result. This delay makes clinicians often depend on further parameters as CBC, C-reactive protein (CRP) and proacalcitonin. Neutrophil CD64 is a glyco-protein produced at low concentration on inactive neutrophilic cell surface and obviously up regulated with the beginning of sepsis.

Methods: This study is a prospective cohort study done on 55 postoperative adult patients of elective surgeries, 33 postoperative patients with sepsis and 22 postoperative patients without sepsis, the majority of patients had more than 2 evaluations. The following parameters were done for each patient as CBC, CRP, neutrophil CD64 and blood culture. Also, follow-up samples were taken from septic group and depending on outcome, reclassification was performed for them as continued sepsis group (n = 18) and improved group (n = 15).

Results: Neutrophil CD64, N/L ratio and CRP levels were significantly increased in patients with sepsis when compared with those without sepsis ($P < 0.05$). The cutoff values of CD64 at 43.6% and 65.2 detected sepsis at 1st and 3rd postoperative days with 90.9%, 78.8% sensitivity and 86.4%, 90% specificity. When CD64 was combined with CRP measurement, improved diagnostic performance was noticed with specificity 100%, PPV 100%, sensitivity 72.7% and NPV 50%. Combining CD64 with N/L ratio also improved the diagnostic performance with specificity 100%, sensitivity 66.7%, NPV 45% and PPV 100%. A significant difference in levels of neutrophil CD64, N/L ratio and CRP ($P < 0.01$) were found between continued sepsis group and clinically improved group by using delta change percentage (dc%).

Conclusion: For postoperative sepsis, neutrophil CD64 is a good promising maker in diagnosis and follow up of patients. Combination of neutrophil CD64 with CRP and N/L ratio are better for diagnosis.

Key Words: Blood culture, CRP, neutrophil CD64, N/L ratio, sepsis.

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INTRODUCTION

Sepsis is caused by impaired regulated response of immunity to microbes and this definition was published by third international consensus definitions for sepsis and septic shock in 2016[1]. Its occurrence among areas differs according to infection risk factors and infection control facilities[2].

Intrahospital mortality due to sepsis accounts 17% of mortality inside hospitals[3]. Postoperative sepsis in elective surgeries incidence rate is rare and accounts 1% of patients. But, its incidence rate in emergency surgeries accounts for 5 - 10 %[4].

Diagnosis depends on general criteria as fever, blood pressure, pulse and organ failure signs and these manifestations are similar to systemic inflammatory immune response syndrome (SIRS) and this causes delaying in the management of cases[5].

Blood culture is considered the mainstay for infection diagnosis, although it can be delayed up to 7 days to give a negative result[6].

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So, biomarkers have been considered with other laboratory findings for physicians in deciding for postoperative management[7].

CBC, CRP and procalcitonin have been most routinely used, but still suffer from false negative and false positive results[8].

A particular promise for neutrophil CD64 has been found in diagnosis of postoperative sepsis[9]. It can discriminate sepsis from non-septic systemic inflammatory response syndrome (SIRS) as published in many studies[10].

It is a glycoprotein on cell surface that is involved in phagocytosis and antibody-dependent cellular toxicity (ADCC)[10]. It is expressed on monocytes and macrophage but its concentration is low on inactive neutrophils which increases with the beginning of sepsis[8].

AIM TO THE WORK

Our aim was to assess the diagnostic and prognostic performance of neutrophil CD64 in postoperative sepsis and to detect best combinations of CD64 with other parameters for early diagnosis of sepsis.

MATERIAL AND METHODS

Study Design

A prospective cohort study was done at Ain Shams University hospitals' general surgery departments and surgical ICUs, over a three-month duration.

Group Classification:

One hundred and thirty-three sepsis evaluations were done on patients of elective surgeries. They were divided into 80 evaluations for sepsis group (*n*=33) collected on 2 or 3 episodes mainly postoperative 1st, 3rd and 5th days and 53 evaluations for control group (postoperative patients with no signs of infection) (*n*=22) and collected on 2 or 3 episodes (1 preoperative evaluation and 2 evaluations on 1st and 3rd postoperative days).

Septic group was further reclassified during follow up into continued sepsis patients (*n* = 18) and clinically improved patients (*n* = 15) which included those who manifested clinically and laboratory improvement.

Collection of Data:

Full history taking, examination and laboratory assessment were done for all patients. Also,

Demographic data were collected including age, sex and sepsis risk factors involving associated comorbidities, surgical procedures and postoperative outcome.

Diagnosis of Sepsis:

A quick version (qSOFA) helps physicians in identifying possible sepsis in settings.

Inclusion Criteria:

Sepsis was suspected in patients with at least two of the three qSOFA criteria used in settings[11]:

1. Respiratory rate of 22 or more breaths / minute,
2. Disturbed mental status,
3. Systolic blood pressure of 100 mm Hg or less.

Exclusion Criteria:

Patients less than 18 years were excluded and patients who had preoperative infections.

ETHICAL CONSIDERATION

Informed consents were taken from included patients in surgical departments in a private place, Ain Shams University. Approval of the study was by the research ethics committee of Ain Shams University Hospitals (Reg. No FWA 000017585).

Sample Collection and Measurements:

Peripheral blood samples were taken when patients were suspected to have sepsis manifestations. They were

subjected for three times evaluations at 1st, 3rd and 5th postoperative days (1st, 2nd and 3rd follow up, respectively), while one time of preoperative sampling from control group was obtained with two postoperative samples at 1st and 3rd postoperative days.

CBC samples were measured by SYSMEX XN-1000 analyzer. CRP was analysed by automated chemistry system (Cobas c311).

CD64% was assessed by flowcytometry[12] using Leuko64 kit (Trillium Diagnostics, Scarborough, ME, USA).

Blood cultures were collected from 24 patients. Eight to ten mL blood were inoculated into BACT/Alert blood culture bottles.

Statistical Method

Statistical Package for Social Science (IBM SPSS) version 27 was used for data. Qualitative data were presented as number and percentages. Parametric data were presented as ranges and mean while median. Non-parametric data were presented as median and inter-quartile range.

Receiver operating characteristic (ROC) curve was constructed to rank independent factors. Diagnostic validity test (sensitivity, specificity, NPV and PPV values) was used for CD64, CRP and CBC parameters.

RESULTS

Comparison between sepsis and control patients with demographic data were shown in the (Table 1).

Non significant differences between two groups were presented regarding age, sex, associated comorbidities and outcome postoperative patients (Tables 1,2 and 3) (Figure 1).

Table 1: Demographic data for the two studied groups.

		Control group	Sepsis group	Test value	*P value*	Sig.
		No. = 22	No. = 33			
Age	Median (IQR)	38.5 (30 – 48)	44 (33 – 56)	-1.195≠	0.232	NS
	Range	18 – 61	18 – 70			
Sex	Female	9 (40.9%)	11 (33.3%)	0.327*	0.567	NS
	Male	13 (59.1%)	22 (66.7%)			

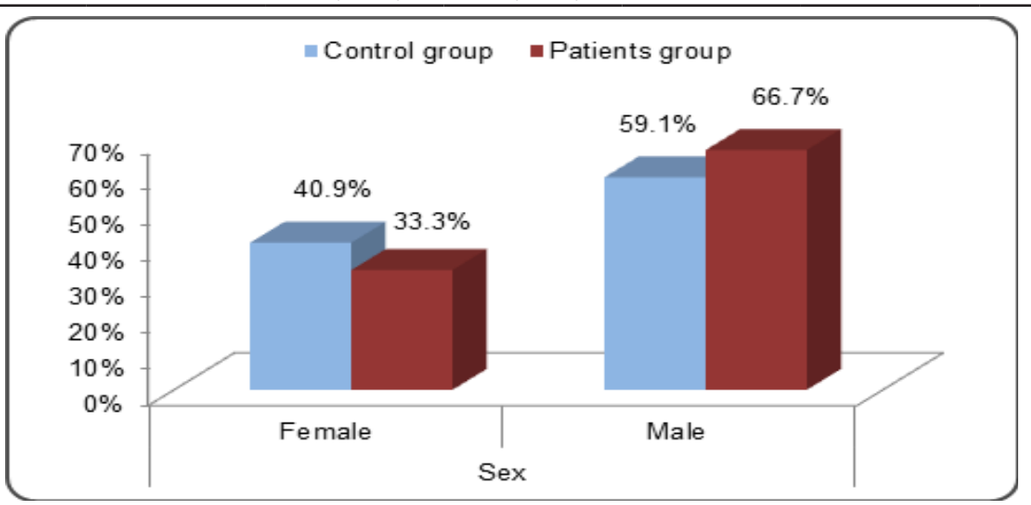

Fig. 1: Comparison between control and sepsis groups regarding gender of the studied subjects

Table 2: Characteristics of study groups as regards the associated comorbidities.

Comorbidities	Control group	Sepsis group	Test value	*P value*	Sig.
	No. = 22	No. = 33			
Medically free	11 (50.0%)	16 (48.5%)	0.012*	0.912	NS
Associated comorbidities	11 (50.0%)	17 (51.5%)			
Polymylitis	1 (4.5%)	0 (0.0%)	1.528*	0.216	NS
Liver cirrhosis	1 (4.5%)	0 (0.0%)	1.528*	0.216	NS
Severe mitral stenosis	1 (4.5%)	0 (0.0%)	1.528*	0.216	NS
Fallot's tetralogy	1 (4.5%)	0 (0.0%)	1.528*	0.216	NS
unstable AF	1 (4.5%)	0 (0.0%)	1.528*	0.216	NS
Mitral regurgitation	1 (4.5%)	0 (0.0%)	1.528*	0.216	NS
Rheumatic heart disease	4 (18.2%)	0 (0.0%)	6.471*	0.011	NS
Chronic kidney disease	0 (0.0%)	1 (3.0%)	0.679*	0.410	NS
Paroxysmal AF	0 (0.0%)	1 (3.0%)	0.679*	0.410	NS
Recurrent glioma	0 (0.0%)	1 (3.0%)	0.679*	0.410	NS
Bronchial asthma	1 (4.5%)	1 (3.0%)	0.086*	0.769	NS
Hypertension	1 (4.5%)	4 (12.1%)	0.917*	0.338	NS
Epilepsy	1 (4.5%)	1 (3.0%)	0.086*	0.769	NS
Chronic liver disease	0 (0.0%)	5 (15.2%)	3.667*	0.056	NS
Diabetes mellitus	2 (9.1%)	7 (21.2%)	1.417*	0.234	NS
Atrial fibrillation (AF)	4 (18.2%)	0 (0.0%)	6.471*	0.011	NS
Ischemic heart disease	1 (4.5%)	2 (6.1%)	0.059*	0.808	NS
Renal impairment	0 (0.0%)	3 (9.1%)	2.115*	0.146	NS

Table 3: Comparison between control and sepsis groups regarding final outcome.

		Control group	Sepsis group	Test value	*P value*	Sig.
		No. = 22	No. = 33			
Outcome	Died	0 (0.0%)	5 (15.2%)	4.490*	0.106	NS
	Discharged	22 (100.0%)	27 (81.8%)			
	Referred	0 (0.0%)	1 (3.0%)			

(Table 4) shows that most sepsis group had clean contaminated (17 out of 33 surgeries represented as 51.5%) and dirty type (3 out of 33 surgeries represented as 9.1%) of surgeries and most control group had clean type (20 out of 22 surgeries represented as 90.9%) of surgeries.

Table 4: Distribution of surgeries according to the type of wound among two studied groups.

Type of surgeries	Name of surgeries	Sepsis	Control	*P value*	Sig.
		No. (%)	No. (%)		
Total number of clean surgeries		13(39.3%)	20(90.9%)	0.000	HS
Total number of clean contaminated surgeries		17(51.5%)	2(9.1%)	0.001	HS
Total number of dirty surgeries		3(9.1%)	0.0(0.0%)	0.146	NS

Seventeen out of twenty four of included postoperative sepsis patients were positive in blood cultures. They showed mainly Klebsiella species (7 out of 17 positive cultures represented as 41.2%), followed by Acinetobacter species (4 out of 17 positive cultures represented as 23.5%) and other bacterial species were isolated e.g., Pseudomonas, Streptococci, Staph aureus, and Candida species as shown in (Figure 2). Three out of twenty four (12.5%) positive blood cultures showed mixed growth of organisms.

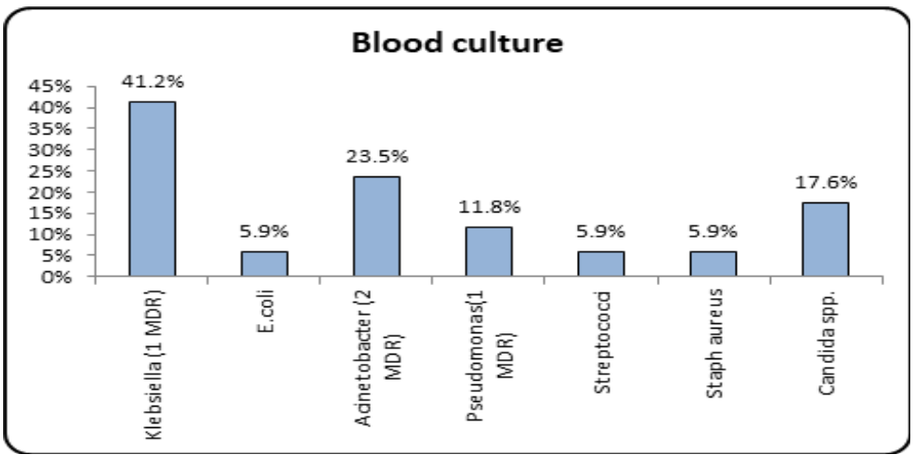

Fig. 2: Microbial presentation of positive blood cultures.

Laboratory data

As regards neutrophil CD64, N/L ratio and CRP, they were significantly higher in sepsis patients than controls during 1st and 2nd follow up. As regards white blood cells (WBCs), there was no significant difference was found during 1st follow up, while they showed significant increase between sepsis and control groups during 2nd follow up. For platelets, sepsis patients were significantly higher than controls during 1st follow up only, but it showed non-significant difference during 2nd follow up as shown in (Tables 5 and 6).

CD64 showed no significant difference among three evaluations of control group (preoperative and postoperative 1st and 2nd follow up) were compared together ($P = 0.169$) and ($P = 0.223$) respectively (Table 7).

While WBCs and CRP levels were significantly high ($P < 0.005$) among three evaluations of control group (Table 7).

Table 5: Comparative analysis between two groups as regards the laboratory evaluation at 1st postoperative day (1st follow up).

1st follow-up		Control group	Sepsis group	*P value*	Sig.
		No. = 22	No. = 33		
TLC	Median(IQR)	11.3 (9.6 – 13.3)	13.4 (10.6 – 19.4)	0.151	NS
	Range	5.9 - 34.4	4.9 - 46		
N	Median(IQR)	6.9 (5.6 – 10.2)	9.1 (6.89 – 12.4)	0.104	NS
	Range	2.9 - 32.3	1.8 - 38.64		
PLT	Median (IQR)	193 (150 – 386)	350 (227 – 524)	0.022	S
	Range	24 – 601	36 – 863		
N/L ratio	Median (IQR)	1.7 (1.3 – 4.6)	7.2 (2.1 – 11.6)	0.002	HS
	Range	0.4 – 13.4	0.6 – 44.9		
CRP	Median (IQR)	12 (5.1 – 48)	96 (48 – 107.1)	0.000	HS
	Range	2 – 101	3.6 – 513.7		
CD64 %	Median(IQR)	39.95 (11 – 78.2)	85.4 (51.3 – 97.6)	0.003	HS
	Range	3 - 99.8	6.44 - 99.9		

Table 6: Comparison between control and sepsis groups regarding laboratory data at 3rd postoperative day (2nd follow-up).

2nd follow-up		Control group No. = 22	Sepsis group No. = 33	*P value*	Sig.
TLC	Median(IQR)	9.8 (8.7 – 11.1)	15.7 (9.7 – 19)	0.032	S
	Range	8.3 - 15.8	5 - 43.5		
N	Median(IQR)	7 (6 – 8.2)	9.3 (7.1 – 14.2)	0.041	S
	Range	1.8 - 12.3	2.4 - 29.6		
PLT	Median(IQR)	255 (199 – 291)	285 (141 – 378)	0.890	NS
	Range	114 – 484	11 - 997		
N/L ratio	Median (IQR)	3.9 (1 – 5.4)	8.8 (3.9 – 12.1)	0.015	S
	Range	0.3 – 12	0.7 – 18.7		
CRP	Median(IQR)	48 (24 – 48)	96 (48 – 100.2)	0.011	S
	Range	2 – 96	2.7 - 146.1		
CD64 %	Median(IQR)	45.8 (32.7 – 57.5)	89 (73 – 97.8)	0.002	HS
	Range	26.3 - 81.5	7.9 - 99.9		

No significant difference between CD64 and N/L ratio among three evaluations of control group was shown but WBCs were significantly increased. CRP showed highly significant difference between preoperative and 1st postoperative day evaluation as shown in (Table 7).

Table 7: Comparative statistics of laboratory data among control group.

		Control group			P value	Sig.
		Pre-operative	1st follow-up	2nd follow-up		
TLC	Median (IQR)	8.8 (7.3 – 12.2)	11.3 (9.6 – 13.3)	9.8 (8.7 – 11.1)	0.018	S
	Range	4.6 – 20.4	5.9 – 34.4	8.3 – 15.8		
N	Median (IQR)	4.4 (3.8 – 6.2)	6.9 (5.6 – 10.2)	7 (6 – 8.2)	0.005	HS
	Range	1.4 – 15.9	2.9 – 32.3	1.8 – 12.3		
PLT	Median (IQR)	280 (204 – 476)	193 (150 – 386)	255 (199 – 291)	0.062	NS
	Range	173 – 751	24 – 601	114 – 484		
N/L ratio	Median (IQR)	1.7 (1 – 3.6)	1.7 (1.3 – 4.6)	4.4 (2.4 – 5.4)	0.301	NS
	Range	0.3 – 7.8	0.4 – 13.4	0.3 – 10.3		
CRP	Median (IQR)	4.2 (3.7 – 6)	12 (5.1 – 48)	3.9 (1 – 5.4)	0.007	HS
	Range	2.37 – 48	2 – 101	0.3 – 12		
CD64 %	Median (IQR)	19.9 (9.2 – 43)	27.7 (10.2 – 42.7)	45.8 (32.7 – 57.5)	0.169	NS
	Range	5.3 – 99.8	3 – 92	26.3 – 81.5		

For correlations between sepsis biomarkers, at 1st follow up, significant positive correlations were revealed between CRP and CD64 and between N/L ratio and CD64 (r = 0.596, 0.437), (*P* = <0.001, 0.011) while CD64 was negatively correlated with lymphocyte count (r = −0.375, *P* = 0.032) as shown in (Table 8).

Table 8: Correlation of CD64 at 1st postoperative day (1st follow-up) with other laboratory data of sepsis patients.

1st follow-up	CD64 %		
	R	*P value*	Sig.
N	-0.053	0.768	NS
L	-0.375*	0.032	S
PLT	-0.098	0.588	NS
N/L ratio	0.437*	0.011	S
CRP	0.596**	<0.001	HS

There was positive correlation between CRP and CD64 at 2nd follow up, but there were negative correlation of lymphocyte count with CD64 and platelet count with CD64 as shown in (Table 9).

Table 9: Correlation of CD64 at 3rd postoperative day (2nd follow-up) with other laboratory data of sepsis patients.

2nd follow-up	CD64 %		
	R	*P value*	Sig.
N	-0.023	0.899	NS
L	-0.383*	0.028	S
PLT	-0.363*	0.038	S
N/L ratio	0.141	0.435	NS
CRP	0.400*	0.021	S

ROC curve at 1st follow up revealed cutoff value of CD64% at 43.6% with specificity 86.36%, sensitivity 90.91%, PPV 90.9% and NPV 86.4%. The cut off value for other parameters was calculated and estimated at the value that achieved the best diagnostic performance and achieved both sensitivity and specificity more than 50% as shown in (Table 10).

Table 10: Sensitivity, specificity, NPV, PPV and area under the curve (AUC) of CD64 versus other laboratory markers at 1st postoperative day (1st follow up).

	Cut off point	AUC	Sensitivity	Specificity	+PV	-PV
PLT	>195	0.686	78.79	61.90	76.5	65.0
N/L ratio	>2	0.754	81.82	61.90	77.1	68.4
CRP	>24	0.818	87.88	66.67	80.6	77.8
CD64%	>43.6	0.767	90.91	86.36	90.9	86.4

(Table 11) shows ROC curve at 2nd follow up revealed cutoff value of CD64 at 65.2% with specificity 90%, sensitivity 78.79%, NPV 56.2% and PPV 96.3%.

When CD64% was combined with CRP, the highest diagnostic performance was achieved with 72.7% sensitivity, 100% specificity, 100% PPV and 50% NPV.

When CD64% was combined with N/L ratio, the best diagnostic performance was achieved with specificity 100%, PPV 100%, sensitivity 66.7% and NPV 45% (Table 11).

Table 11: Sensitivity, specificity, PPV, NPV and area under the curve (AUC) of CD64 versus other parameters at 3rd postoperative day (2nd follow up).

	Cut off point	AUC	Sensitivity	Specificity	+PV	-PV
N/L ratio	>5.4	0.758	69.7	80.0	92.0	44.4
CD64%	>65.2	0.864	78.79	90.00	96.3	56.2
CRP	>48	0.800	69.70	80.00	92.0	44.4
CD64%+ CRP	–	0.842	72.73	100.00	100.0	50.0
CD64% + N/L ratio	–	0.801	66.67	100.00	100.0	45.0

Prognostic Evaluations

During follow-up of septic patients; patients were reclassified to two groups (continued sepsis patients (n = 18) and clinically improved group (n = 15).

Delta change (dc) percent was used with the following equation:

$$\frac{\text{(level of a studied parameter (after) - level (before)}}{\text{level before}} \times 100$$

The following were the main results:

- As regards PLT count, significant difference was revealed between both groups ($P = 0.023$).
- As regards CD64%, CRP and N/L ratio, highly significant difference was shown between both groups ($P = 0.007$), ($P < 0.001$) and ($P = 0.001$) respectively.

DISCUSSION

Postoperative sepsis represents a serious medical problem that its incidence is more than 1% after elective surgeries and 5-10% after non-elective surgeries[4,13].

Our study included 133 septic evaluations for 55 postoperative patients, 33 patients with sepsis and 22 patients without sepsis.

Most sepsis group had clean contaminated (51.5%) and dirty type (9.1%) of surgeries and most control group had clean type (90.9%) of surgeries, and this was in agreement with ***Yin et al.***[14] which had clean contaminated (45.1%) and dirty type (8.4%) of surgeries, but clean type of surgeries was 37.9% in all studied patients.

For blood culture, the most common organism found was Klebsiella species (41.2%). This comes in line with ***Gharebaghi et al.***[15] who reported that Klebsiella spp. were 33.8%, but not matched with ***Molina et al.***[16] whose result findings showed mostly E.coli spp. (16.8%).

A highly significant increase of neutrophil CD64 was found in septic group when compared to controls at 1st and 2nd follow up with the best diagnostic cut off value achieved >43.6% and >65.2% with a specificity of 86.4% and 90% and sensitivity of 90.9%and 78.8%respectively. These results agree with most of researches as regards CD64 expression in postoperative sepsis in which sensitivity and specificity reached a high level of 80% or more[11, 17].

Our results were in opposite with Briggs and his colleagues[18] who revealed no significant difference of neutrophil CD64 between control and sepsis groups as all patients were subjected preoperatively to trauma as accidents, concluding that post traumatic injuries raise CD64 masking any increase as a result of sepsis.

There was no statistically significant difference was found when preoperative control group compared with their 1st and 2nd follow up evaluations, but this came in contrast with Djebara and his colleagues[19] whose research showed significant difference of CD64 between their preoperative and postoperative evaluation of the control patients. This could be contributed to variations of cytokine concentrations between the groups. IFN gamma and IL-12 were found to be stimulators of CD64 expression.

As regards CRP, there was statistically significant increase in serum of sepsis group at 1st follow up when compared to control group with the best diagnostic value of the cut off achieved >24 mg/L with a specificity of 66.7% and sensitivity of 87.9% and. These are close to Manasa and Mahantesh results[20] who reported that CRP showed a specificity of 83% and sensitivity of 92% with a cutoff at 20.0 mg/L. At 2nd follow up, the best diagnostic cut off level at 48 mg/L, with a diagnostic sensitivity of 69.7% and specificity 80%. These results are close to Aaron and his colleagues' results[21] who reported that CRP showed a specificity of 66.13% and sensitivity of 72.7% with a cutoff at 44.32 mg/L.

The combination between CD64 (at 65.2%) + CRP (at 48 mg/dl) in discriminating patient from the control revealed a diagnostic sensitivity of 72.73% and specificity 100.0%. These findings come in line with ***Dimoula et al.***[22] and ***Djebara et al.***[19]. They investigated the specificity and sensitivity of CD64/CRP combination which were 99% and 92% respectively, but they differ at a specific time that this combination was at 1st postoperative day not at 3rd day as our results.

WBCs were similar to the previous study presenting wide ranged sensitivity and specificity from 31 to 90%[23-25].

Our results as regards Neutrophil/Lymphocyte (N/L) ratio at 1st follow up show a cut off >2, sensitivity 81.82%, NPV 68.4%, PPV 77.1 and specificity 61.9%. ***Kriplani et al.***[25] reported a cut off near to our result which is 2.45, a specificity of 31% and a sensitivity of 87%. In our research, at 2nd follow up, N/L ratio results showed a cut off at 5.4, sensitivity 69.7%, NPV 44.4%, PPV 92.0 and specificity 80.0%. These results come in line with Gurol and his colleagues[26] who reported a cut off near to our result which is 5.0, a sensitivity of 57.8% and a specificity of 83.9%.

These differences as regards N/L ratio could be explained by the fact of pathophysiological variations of the patients[27].

The combination between CD64 (at 65.2%) + N/L ratio (at 5.4) in discriminating patient from the control showed diagnostic sensitivity of 66.67% and specificity 100.0%.

Tang et al.[28] reported that CD64/N/L ratio combinations can be used in the clinic to improve diagnostic accuracy of infections.

Second most important parameter of CBC is platelet count in this study. Its sensitivity was 78.7% and specificity was 61.9% with a cut off value 195.000/μL and those were close to results of ***Yao et al.***[29] that mentioned the cut off value of platelets is 173.5/μL with a specificity of 50.89% and a sensitivity of 76.77%.

Our work differs with ***Hua et al.***[30] that reported the cut off level of platelets is 84/μL with sensitivity of 55.6% and specificity of 91.8%.

Correlation statistics between the different parameters was performed, which revealed positive correlation between neutrophil CD64% and CRP levels in sepsis group at 1st and 2nd follow up.

These results are in agreement with the previous reports of Tang and his colleagues[28].

On the other hand, De Almeido Barbosa and his colleagues[31] reported that there was no significant correlation between CD64 expression and CRP in septic groups.

Also, at 1st follow up, there was significant positive correlation of N/L ratio and CD64. But, ***Tang et al.***[28] reported a negative correlation between both ofthem.

As regards correlation between CD64 and the other hematological indices, there was a significant negative correlation of CD64 percent and platelet count and a non-significant correlation with TLC and lymphocytes at 3rd postoperative day. Our work comes in line with ***Hashem et al.***[32] As regard the correlation between CD64 and PLT count, as they reported that there was negative correlation between them ($r = -0.298$, $p < 0.05$).It indicates that decrease in platelet count is considered as one of sepsis complications and could be used as a marker of severity of sepsis as it is involved in SOFA score.

Also, we assessed the follow up levels of other parameters as N/L ratio, CRP and platelets using delta change and they revealed significant variations between continued septic and improved groups for CRP ($P < 0.001$), N/L ratio ($P = 0.001$), CD64% ($P = 0.007$) and platelet count ($P = 0.023$).

These results come in agreement with Huang and his colleagues[33] who added that neutrophil CD64 and CRP approved to be good predictors of sepsis mortality, also ***Gharebaghi et al.***[15] who reported that high N/L ratio was associated with unfavorable prognosis in septic patients and its level was significantly higher in non-survivors.

CONCLUSION

Neutrophil CD64 is a realistic biomarker for postoperative sepsis diagnosis and prognosis. The diagnostic ability of CD64 can be improved by its combination with N/L ratio and CRP.

CONFLICTS OF INTEREST

No conflict of interest was found.

AUTHORS' CONTRIBUTIONS

Mustafa Z.M. has done the statistical study and the review. Shaker O.A., Abdel Halim R.M. and AbderRazek M.A. were involved in revision of the scientific writing, statistical analysis and follow up of the study.

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الأداء التشخيصي لدلالة الخلايا المتعادلةCD64 كمؤشر مبكر لتسمم الدم بعد العميات الجراحية

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الخلفية العلمية: تسمم الدم هو متلازمة إكلينيكية متعددة العوامل تتضمن اختلال وظيفي للأعضاء يهدد حياة المريض وذلك لاضطراب مناعة المريض ضد العدوى.

وتعتبرمزارع الدم هي "المعيار الذهبي" للكشف عن العدوى في الجسم، ويمكن أن تستغرق ٧ أيام لتعطي نتيجة "سلبية" موثوقة.

وهذا التأخير يجعل الأطباء غالبا ما تعتمد على الأعراض الإكلينيكية وتحاليل الدم مثل صورة الدم الكاملة، بروتين سي التفاعلي، بروكالسيتونين كمؤشرات للعدوى.

وتعتبرالدلالة CD64% بروتين سكري يوجد على سطح خلايا الدم المتعادلة غيرالنشطة بتركيزمنخفض، ولكن يزداد وجوده بشكل ملحوظ في بداية تسمم الدم.

طرق البحث: تعد دراستنا دراسة مرتقبة جماعية، يتم إجرائها على ٥٥ مريض بالغ، ٣٣ مصاب بالعدوى و٢٢ غير مصاب بالعدوى بعد العمليات الجراحية و أغلب المرضى تعرضوا لأكثر من مرتين سحب عينات لتقييم العدوى عندهم، ويشمل التقييم المعملي على صورة دم كاملة، بروتين سي تفاعلي، مزرعة دم، بالإضافة إلى قياس مستوى الدلالةCD64% بجهاز التدفق الخلوي وذلك بجانب التشخيص الإكلينيكي، كما يوجد متابعات تقييمية للمصابين بالعدوى وقد قسموا على حسب حالتهم إلى١٥مريض في تحسن إكلينيكي و١٨مريض في حالة تسمم دم مستمر.

النتائج: أظهرت نتائج الدراسة زيادة ذات دلالة إحصائية عالية في مستويات الدلالةCD٦٤٪ ونسبة الخلايا المتعادلة/ الخلايا الليمفاوية ومستويات بروتين سي التفاعلي في الحالات المصابة بتسمم الدم عند مقارنتها بالحالات الضابطة.

وقد بلغ مستوى القطع التشخيصي للدلالة CD64% ٤٣,٦٪ و٦٥,٢٪ فى اليوم الأول والثالث بعد العمليات بحساسية تشخيصية ٩٠,٩٪ و٧٨,٨٪، ونوعية بنسبة ٨٦,٤٪ و٩٠٪ على الترتيب.

وكانت أحسن كفاءة لقياس الأداء التشخيصى للدلالة CD64% مع بروتين سى التفاعلى بحساسية تشخيصية ٧٢,٧٣٪ ونوعية بنسبة ١٠٠٪ وقيمة تنبؤية إيجابية ١٠٠٪ وسلبية ٥٠٪، وكذلك عند قياس الأداء التشخيصى للدلالة CD64% مع نسبة الخلايا المتعادلة /الخلايا الليمفاوية كانت بحساسية تشخيصية ٦٦,٧٪ ونوعية بنسبة ١٠٠٪ وقيمة تنبؤية إيجابية ١٠٠٪ وسلبية ٤٥٪.

كما أن نسبة تغير الدلتا بين المرضى فى تسمم الدم المستمر والمرضى المتحسسين إكلينيكيا أظهرت اختلافاً ملحوظاً فى مستوى الدلالة CD64% وبروتين سى التفاعلى ونسبة الخلايا المتعادلة / الليمفاوية ($P<0.01$).