Use of the Monocyte Distribution Width (MDW) in the diagnosis of sepsis

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INTRODUCTION

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection. Worldwide, it remains one of the leading causes of death in intensive care units. In addition to the standard biochemical parameters (CRP, IL-6, Presepsin, Procalcitonin), hematological parameters have recently been investigated in the diagnosis of sepsis. These include monocyte distribution width **(MDW),** neutrophil to lymphocyte ratio **(NLR),** white blood cell count **(WBC),** absolut monocyte count **($MO_{\#}$)** and **ICIS score.**

AIM

- to compare MDW parameter by ROC analysis with NLR, WBC, $MO_{\#}$ and ICIS score in septic patients, these analyzers were used:

- **DxH 900 (Beckman Coulter)**

XN-20™ (Sysmex)

MATERIAL AND METHODS

- Table 1: Descriptive statistic of 60 participants:

	Donor group	Septic patients
Number of participants	38	22
Sex: number [Female/Male]	19/19	10/12
Median of Age [years]	60	57
Range of ages	22–81	30–80

- the **MDW** parameter was measured on Beckman Coulter DxH 900 analyzer and parameters **NLR, WBC, MO# and ICIS score** were measured on Sysmex XN-20™ (samples: venous blood, S-Monovette® 2.6 mL K_3EDTA),
- Table 2: Reference range:

Parameter	Reference range (adult population)
MDW	≤21.5
NLR	0.7–3.0
WBC	4–10 x10^9/L
MO#	0.8–1.2 x10^9/L
ICIS	0–4

- the statistical evaluation was performed using MedCalc 22.021 (ROC analysis).

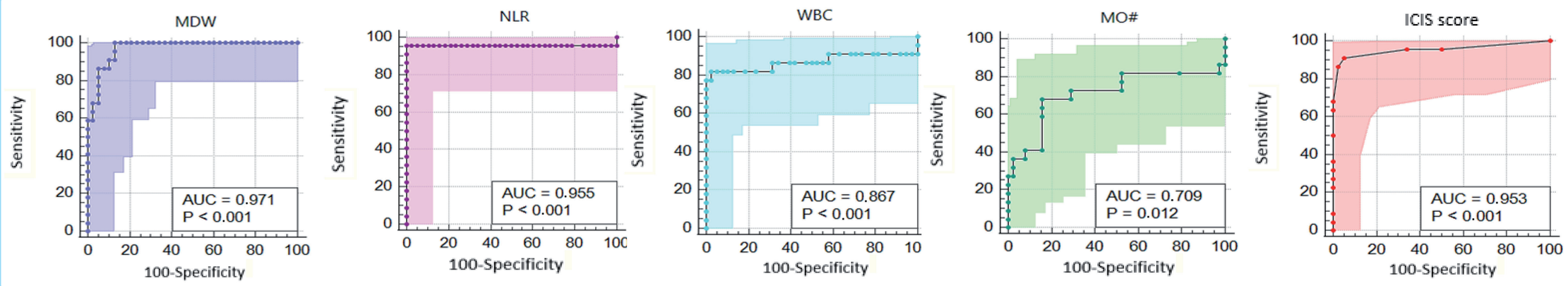
RESULTS

Statistical and graphical evaluation of ROC analysis:

- ROC curves for all parameters and the AUC differences between MDW and the selected parameters are summarized in Table 3,
- approximate assessment of test quality by area under the curve:
  - 0.50 to 0.75 = justified,
  - 0.75 to 0.92 = good,
  - 0.92 to 0.97 = very good,
  - **0.97 to 1.00 = excellent,**
- the best of the compared parameters with the highest AUC value is **MDW (0.971),**
- followed by **NLR (0.955), ICIS score (0.953), WBC (0.867) and $MO_{\#}$ (0.709),**
- a calculated cut-off criterium of MDW **>20.43** associated by Youden index was lower than the cut-off value MDW >21.5 recommended by the Beckman Coulter,
- statistically significant difference was confirmed by comparing MDW with $MO_{\#}$.

- Table 3: Overview of ROC analysis

	MDW ~ NLR	MDW ~ WBC	MDW ~ MO#	MDW ~ ICIS
The difference between AUC	0.017	0.104	0.262	0.019
Standard error	0.050	0.070	0.086	0.040
95% CI	-0.081–0.114	-0.034–0.242	0.094–0.430	-0.060–0.097
P value	P = 0.737	P = 0.139	P = 0.002	P = 0.642
Is there a significant difference	NO	NO	YES	NO



CONCLUSIONS

The ROC analysis is a fundamental tool for diagnostic test evaluation. **ROC curve** is a plot of the true positive rate (Sensitivity) in function of the false positive rate (100–Specificity) for different cut-off points of the parameter. Each point on the ROC curve represents a sensitivity/specificity pair corresponding to a particular decision threshold. The Area Under the ROC curve **(AUC)** is a measure of how well the parameter can distinguish between two diagnostic groups (diseased/normal). The best diagnostic test will be characterized by the ROC curve with the largest Area Under Curve (AUC). **If the area is equal to 1, the test is ideal and has 100% sensitivity and specificity.**

Results of the ROC analysis show that the best of the compared hematological parameters is MDW with the highest AUC value **(0.971).** It is obtained by measuring CBC with differential leukocyte count on a Beckman Coulter **DxH 900** analyzer and it is **FDA approved** for the diagnosis of sepsis. The calculated cut-off value of MDW associated by Youden index J is **MDW >20.43.** The combination of MDW with other biochemical and hematological markers has a great potential for early diagnosis and prediction of sepsis prognosis together with clinical state of patients.

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