The Diagnostic Ability of Monocyte Distribution Width (MDW) is not affected in Patients with Hematological Malignancy or Immune Suppression

Iris Castro[1], Diana Careaga[1], Robert Magari[1], Elliott Crouser[2], Joseph Parrillo[3], Octavia Palmer[4], and Liliana Tejidor[1]

[1]Beckman Coulter, Miami, FL, [2]The Ohio State University Medical Center, Columbus, OH, [3]Hackensack University Medical Center, Hackensack, NJ, [4]University of Pittsburgh Medical Center, Pittsburgh, PA

INTRODUCTION

Sepsis is a systemic inflammatory response to infection and a rapidly progressing, life-threatening condition that can lead to organ failure and shock if not treated immediately. The likelihood of developing sepsis increases in patients with hematological malignancies, as systemic chemotherapy results in immune suppression. When neutropenic, the patient is vulnerable to invasive infection which can potentially cause overwhelming sepsis and death. Consequently, early diagnosis of sepsis in these high risk population of patients is very important for reducing mortality and alleviating healthcare costs. MDW is a novel parameter that has been shown to identify sepsis in the emergency department (ED) with good diagnostic accuracy.

METHODS

Patient Enrollment: Subjects were enrolled from EDs at three U.S. academic centers. The study enrolled adults, 18- 89 years, whose evaluation included a complete blood count (CBC) with differential upon presentation to the ED. Data on the presence of pre-existing conditions were collected for all enrolled subjects as part of the medical record extraction.

We performed a post-hoc analysis of the data that included patients with a pre-existing diagnosis of hematological malignancy and immune suppression. These conditions were selected based on their potential impact to the measurement of MDW.

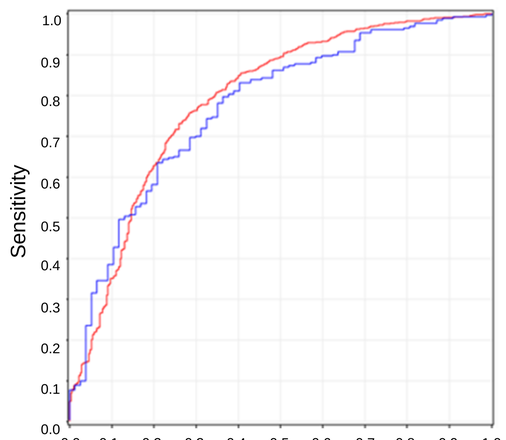
White Cell Volume Determination: All blood samples were analyzed on a UniCel® DxH 800 Hematology analyzer (Beckman Coulter, Inc.) within 2 hours of collection.

Statistical Approach: Diagnostic ability was evaluated in terms of the area under the curve (AUC) sensitivity, specificity, and analysis of area receiver operating characteristic (ROC) curves.

RESULTS

AUC and ROC curves of malignant and non-malignant groups and subjects with and without immune suppression were not statistically different (Figures 1-2). These results indicate that the diagnostic ability of MDW is the same in both groups with and without the particular pre-existing condition. Furthermore, analyses in a subset of patients with neutropenia (ANC<1500) demonstrated a performance trend that is similar to that of all ED patients with AUC =0.720 (*data not shown*).

Receiver Operating Characteristics Curve for MDW in Malignancy



Number of Subjects With and Without Malignancy by Diagnosis

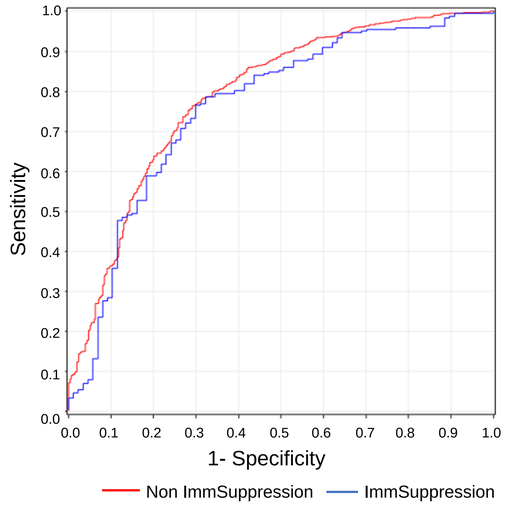
Sepsis	No Malignancy	Malignancy	Total	Percent (%)
No	1513	260	1773	14.7
Yes	308	77	385	20.0
Total	1821	337	2158	15.6
Percent (%)	16.9	22.8	17.8	.

Area Under the Curve (AUC) for Subjects With and Without Malignancy

	AUC	SE	Lower	Upper
Malignancy Only	0.772	0.0307	0.711	0.832
No Malignancy	0.789	0.0153	0.759	0.8
All Samples	0.789	0.0135	0.762	0.815

Figure 1. Diagnostic capability of MDW in hematological malignancy

Receiver Operating Characteristics Curve for MDW in Immune Suppression



Number of Subjects With and Without Immune Suppression by Diagnosis

Sepsis	No Immune Suppression	Immune Suppression	Total	Percent (%)
No	1530	243	1773	13.7
Yes	298	87	385	22.6
Total	1828	330	2158	15.3
Percent (%)	16.3	26.4	17.8	.

Area Under the Curve (AUC) for subjects With and Without Immune Suppression

	AUC	SE	Lower	Upper
Immune Suppression Only	0.763	0.032	0.701	0.825
No Immune Suppression	0.790	0.015	0.760	0.820
All Samples	0.789	0.014	0.762	0.815

Figure 2. Diagnostic capability of MDW in patients with Immune Suppression

REFERENCES

1. *Crouser et. al, CHEST 2017;152(3):518-526*.
2. *Crouser et. al. CCMED 2019; Manuscript in Press.*

CONCLUSION

In a multi-center prospective clinical trial (2,158 adults), we showed that MDW could be useful for early detection of adults having or developing sepsis in the emergency department. In addition, we observed that the diagnostic ability of MDW to identify septic patients does not seem to be affected in patients with hematological malignancy or immune suppression. Additional studies are needed to further establish performance in these critical populations.