CELLULAR INDICES OF PE

Mala Niverthi, Vivaan Karnik,
Neha Thomas, Fakiha Siddiqui, Jawed Fareed, and Atul Laddu,
Global Thrombosis Forum, Suwanee, GA, and Loyola University, Chicago, IL
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BACKGROUND

PE is a life-threatening condition accounting for over 100,000 deaths annually in the United States and is the third leading most common cause of cardiovascular death. PE is associated with complex inflammatory, hematological processes, and hemostatic imbalances. Formation of a thrombus within the pulmonary arteries or its branches leads to impairment of blood flow and oxygen exchange in the lungs.

HYPOTHESIS

1. Inflammatory biomarkers and cellular indices of inflammation will be elevated in acute PE patients relative to healthy controls.
2. Quantified through clinical laboratory testing and measurement of thrombo-inflammatory biomarkers
3. May have predictive implications about measurable clinical outcomes
4. Since PE reflects inflammatory and coagulation imbalances, it is assumed that there will be abnormal findings that suggest an increased risk of all-cause mortality. Our research assessed the predictive ability of complete blood count data for all-cause mortality, and the current sPESI model with additional blood cellular indices to improve the predictive skill of the model.

METHODS

We researched the literature on the pathophysiology of PE. The current and most widely used risk stratification model (simplified pulmonary embolism severity index, sPESI) is a scoring system that uses 6 clinical variables to predict death and prognosis, but it suffers from a low positive predictive variable suggesting that these models have suboptimal accuracy in patients with high risk.

RESULTS

There has been growing interest in demonstrating some blood cellular indices obtained from a complete CBC and their correlation in predicting prognosis in patients with PE (Figure 1).

RESULTS contd.

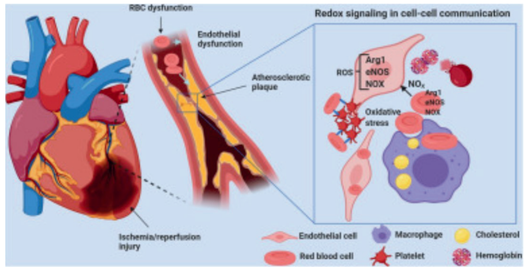

Figure 1: Interactions seen between red blood cells and vascular wall.

CBC with differential is a widely used, low-cost test that can augment current risk stratification tools for all-cause mortality in acute PE patients. Certain cellular indices such as platelet-lymphocyte ratio (PLR), neutrophil-lymphocyte ratio (NLR) and lymphocyte-monocyte ratio (LMR) have been identified as markers of systemic inflammation but are associated with poor prognosis in patients with acute PE and all-cause mortality in PE patients (Figure 2).

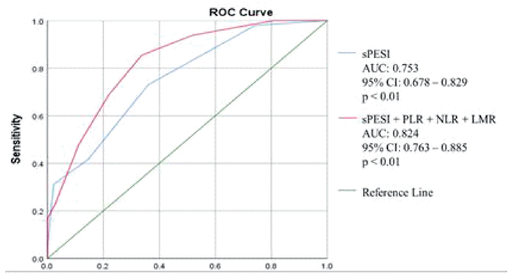

Figure 2: Characteristic curve assessing sPESI and blood cellular indices to predict all-cause mortality in acute PE cases.

sPESI (red cell distribution width, hematocrit, and NLR) had the better predictive ability as compared to sPESI alone. Blood cellular indices contribute an inflammatory and hemodynamic perspective not currently included in sPESI. A close association between PLR, NLR, and LMR and all-cause mortality in PE patients has been demonstrated. Lymphopenia and elevated neutrophil count are associated with pro-inflammatory states during cardiopulmonary events, which may increase risk for thrombotic events. Platelets are significantly decreased immediately after a thrombotic event. The composite sPESI model, including PLR, NLR, and LMR exhibits higher sensitivity which allows for improved detection of patients who are at high risk for death. Sagalov et al (2021) concluded that lower levels of platelets are associated with increased mortality in patients with PE (Figure 3).

RESULTS contd.

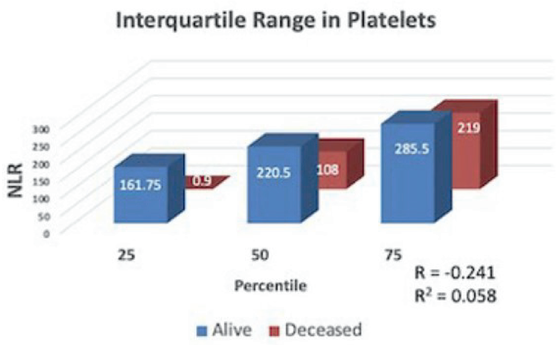

Figure 3: Interquartile range in patients

Figure 4 indicates the specificity and sensitivity of various indices for PE.

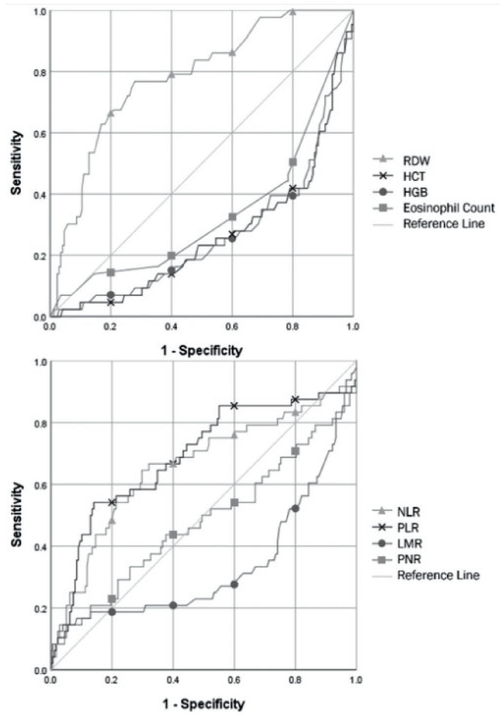

Figure 4: Specificity/sensitivity of indices

Ratios found to be associated with inflammation:

1. NLR: neutrophil to lymphocyte ratio
2. PLR: Platelet to lymphocyte ratio
3. Plt: Hgb - Platelet to hemoglobin

CONCLUSION

The composite sPESI model, including PLR, NLR, and LMR exhibits higher sensitivity, and of the various cellular indices for PE, PLR, NLR, and LMR appear to be the most associated with all-cause mortality in PE patients. sPESI alone has poor positive predictive value which limits its utility in high-risk patients, our composite model PPV was 50% compared to 35.4% with sPESI alone and offered similar NPV at 91.3% for the composite model and 89.9% for sPESI alone. Lower levels of platelets are associated with increased mortality in patients with pulmonary embolism. Complete blood count data is routinely obtained in emergency and inpatient settings. It is a widely used, low-cost, convenient laboratory test that offers an abundance of metrics that can be incorporated within sPESI to improve the model's predictive ability for predicting PE risk mortality.

IMPORTANCE OF OUR WORK

The cellular indices, such as PLR, NLR, and LMR exhibit a higher sensitivity which allows for improved detection of patients who are at high risk for death. Of the various cellular indices for PE, PLR, NLR, and LMR appear to be the most associated with all-cause mortality in PE patients.

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