The Correlation of Angiopoietin-2 with Pulmonary Embolism Severity, Right Ventricular Dysfunction, and Intensive Care Unit Admission

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Introduction

- Risk stratification of patients presenting with acute pulmonary embolism (PE) is important for rapid identification of those at risk for hemodynamic collapse and mortality.
- Existing risk prediction models have only modest correlation with early mortality.
- Identification of additional prognostic factors that correlate with poor outcomes in PE patients is therefore of critical importance.
- Angiopoietin-2 (Ang-2) is a signaling molecule involved in angiogenesis and is upregulated in response to tissue hypoxia.
- The purpose of our study was to assess the association of Ang-2 with
  1. PE severity,
  2. Echocardiographic and invasive hemodynamic markers of right ventricular (RV) dysfunction, and
  3. Need for intensive care unit admission.

Methods

- Blood samples were obtained from patients presenting to our institution with acute PE.
- Demographic, clinical, echocardiographic, and invasive hemodynamic data were recorded.
- Blood samples were analyzed using commercially available ELISA kits for Ang-2.
- Patients were divided into tertiles based on the degree of elevation of Ang-2.

Results

	Low risk (n=18)	Intermediate risk (n=39)	High risk (n=6)	Massive with shock (n=2)	p
Ang-2 (pg/nL)	3599 [2679-5124]	3850 [3160-4773]	10254 [6097-21618]	15084 [6154-24015]	0.03

Table 1. Level of Ang-2 (expressed as median ± IQR) in various PE risk groups.

	Lowest Tertile	Middle Tertile	Highest Tertile	P value
RV/LV ratio	1	1.1	1.2	0.23
RV AT (msec)	97.5	87	74	**0.05**
RVOT VTI (cm)	14	12.6	9	**0.04**
LVOT VTI (cm)	17.5	19.2	16	0.1
IVC (mm)	11	12	17	**0.06**
TAPSE (mm)	19.4	17.9	15.7	0.2
PASP (mmHg)	39.1	43.1	61.9	**<0.01**
S' (cm/s)	13	14.5	11.4	0.1

Table 2. Echocardiographic data stratified by Ang-2 tertile.

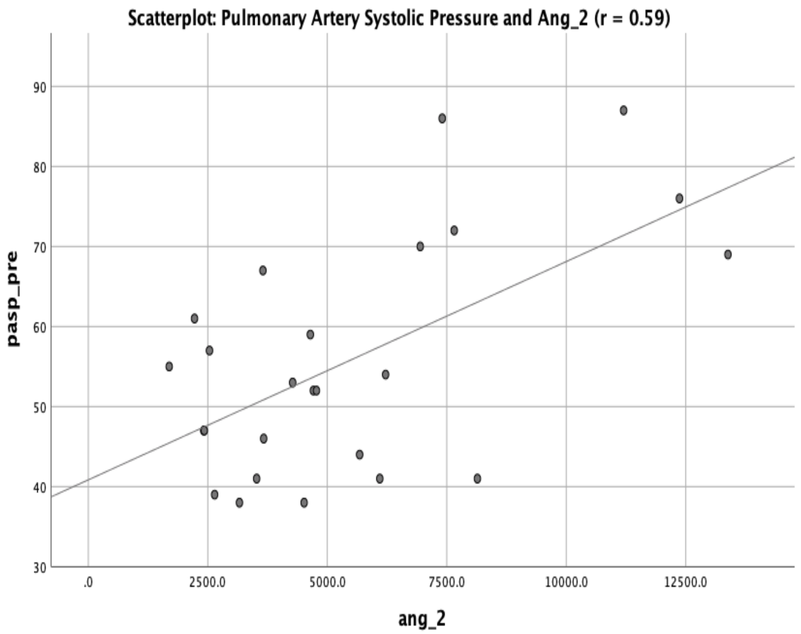

Figure 1. Scatterplot: Pulmonary Artery Systolic Pressure and Ang-2.

Results

- A total of 65 patients were included in the study.
- Ang-2 correlated with PE risk stratification (Table 1).
- Ang-2 also correlated with echocardiographic markers of RV dysfunction (Table 2).
- Among patients in whom invasive hemodynamic data was available (n=25), Ang-2 had a negative correlation with cardiac index (R= -0.47, p<0.01) and pulmonary artery (PA) pulsatility index (R= -0.5, p<0.01), and a positive correlation with PASP (R=0.59, p<0.01) (Figure 1).
- An Ang-2 level of >4,101 pg/nL had an odds ratio (OR) of 7.4 (95% CI 1.53-12.5, p<0.01) for intensive care unit (ICU) admission.
- Odds ratios for other commonly used prognostic factors evaluated in this study included peak lactate (OR 4.5, 95% CI 1.6-12.3, p <0.01) and PESI score (OR 1.02, 95% CI 1.003-1.028, p=0.02).

Conclusions

- Ang-2 correlates with PE severity and RV dysfunction.
- Elevations of Ang-2 are predictive of ICU admission.
- Ang-2 holds promise as a novel marker that can aid in risk stratification for this patient population.
- Whether Ang-2 elevations correlate with mortality in acute PE is the subject of our ongoing research.