Circulating Apoptotic Progenitor Cells
A Novel Biomarker in Patients With Acute Coronary Syndromes

Shmuel Schwartzenberg, Varda Deutsch, Sofia Maysel-Auslender, Sarina Kissil, Gad Keren, Jacob George

**Background**—Progenitor CD34 cells are capable of differentiating into endothelial cells and play a role in neoangiogenesis. Circulating CD34⁺ cells and endothelial progenitor cells are increased in acute coronary syndrome (ACS) patients possibly because of peripheral mobilization. We tested the hypothesis that circulating apoptotic progenitors are detectable in healthy subjects and altered in ACS patients.

**Methods and Results**—Peripheral blood mononuclear cells were isolated by Ficoll density gradient from 53 patients with ACS undergoing coronary angiography and 27 healthy subjects. Apoptosis in progenitor CD34⁺ cells was assessed using the Annexin V-PE/7-AAD detection kit, and fluorescence-activated cell sorter analysis was performed with triple staining for CD34, annexin-V, and 7-AAD. The percentage of apoptotic CD34⁺ progenitors was determined in the 2 subject groups and correlated with clinical characteristics. The percentage of apoptotic CD34⁺ progenitor cells was significantly increased in patients with ACS as compared with healthy subjects and was associated with the extent of coronary stenosis by angiography. There was no significant correlation between apoptotic progenitor CD34⁺ cells and the other parameters that we examined (age, smoking, hypertension, hyperlipidemia, diabetes mellitus, ejection fraction, creatinine levels, or taking any of the various medications, including beta blockers, thiazides, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, calcium blockers, nitrates, or statins).

**Conclusion**—We established for the first time to our knowledge an assay to detect circulating apoptotic progenitor cells using fluorescein isothiocyanate–anti-CD34 MAb, annexin V-PE, and 7-AAD and found that apoptotic CD34⁺ cells are increased in ACS patients and in patients with more extensive coronary artery disease. This novel assay may shed new light on the factors governing the hemeostasis of progenitor CD34⁺ cells. ([Arterioscler Thromb Vasc Biol. 2007;27:e27-e31.])

**Key Words:** progenitor CD34⁺ stem cells ■ endothelial progenitor cells ■ endothelial microparticles ■ apoptosis ■ Annexin V
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