The Effect of Anemia on Endothelial Progenitor Stem Cells (EPCs) and Young Endothelial Cells (YEC) Circulating in the Peripheral Blood of Patients with Acute Coronary Syndrome (ACS)

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Background: Anemia is an independent predictor of poor prognosis in ACS patients. Endothelial progenitor stem cells (EPCs) are bone marrow-derived hematopoetic stem cells that are mobilized into the circulation in response to tissue ischemia. The number of circulating EPCs increases within days of ACS, however, there is no data regarding the effect of anemia on EPCs and on young endothelial cells' (YEC) function.

Hypothesis: Anemia may cause impaired vascular healing post ACS due to lack of EPCs' production and impaired YEC function. Our purpose was to study the effect of anemia on EPCs and YEC function in patients with ACS.

Methods: Levels of EPCs were examined in ACS patients with chronic anemia (anemia) (n=11) and in ACS patients without anemia (control) (n=11). Two blood samples were drawn: on admission and 4-7 days afterwards. EPCs were cultured on Fibronectin with Endocult liquid medium for 5 days (Hill protocol) and colony forming units (CFU) were counted. Laboratory analysis - was performed on both samples. After 5 days in culture, endothelial cell linage was confirmed (immune-staining: CD31, Tie-2) and a migration assay (Boyden chamber and VEGF-2) indicated YECs' function.

Results: A significant difference was observed in CFUs counts between anemic patients and controls on admission (6.2±1.5 vs. 13.2±2.2, p<0.0001) (Table 1); 4-7 days later there was an increase in CFU in the anemic group to 7.7±1.9 (p=0.0002) and from 13.2±2.2 to 17.7±3 in controls (p<0.0001) (Table 1). The CFUs looked less organized and less mature in the anemic group (Figure 1, 2). YEC migration on admission was inhibited in anemic patients (p=0.05) (Table 2). YEC migration 4-7 days afterwards was increased in both groups, but was more significant in controls (p=0.02) (Table 2).

Conclusions: Anemic ACS patients express reduced number of EPCs and endothelial cells dysfunction on admission and 4-7 days after acute ischemia. These phenomena could explain part of the mechanism of poor prognosis observed in anemic ACS patients.

Table 1: Colony Forming Units of Endothelial Progenitor Stem Cells

	CFU (anemia)	CFU (control)	p - value
Day 1	6.2 ± 1.5	13.2 ± 2.2	< 0.0001
Days 4-7	7.7 ± 1.9	17.7 ± 3	< 0.0001
p - value	0.0002	< 0.0001	

Table 2: migration assay of Young Endothelial Cells

	migrated cells (anemia)	migrated cells (control)	p - value
Day 1	10083 ± 5092	16500 ± 8800	0.05
Days 4-7	10615 ± 5070	18800 ± 9400	0.02

Keywords: anemia, ACS, EPCs, YECs.

Figure1: CFU of an anemic patient

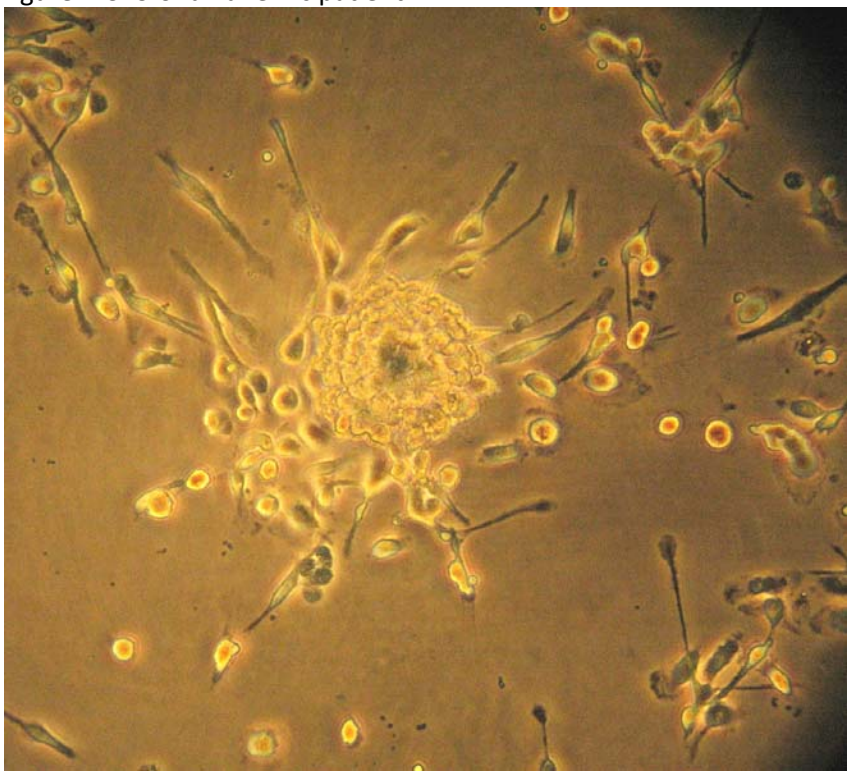

Figure 2: CFU of a control patient