428e Effect of Fluid Shear Stress on the Differentiation of Endothelial Progenitor Cells

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Endothelial cells (ECs) constitute the inside cellular lining of all blood vessels. ECs differentiate from endothelial progenitor cells (EPCs) during the early stage of embryonic development. EPCs also exist in adults and can be found in bone marrow and peripheral blood. Circulating adult EPCs can differentiate into ECs and have been proposed to play an important role in several physiological and pathological processes, such as angiogenesis (the formation of new blood vessels) and wound healing. When EPCs adhere to the vascular wall, they are subjected to fluid shear stress as a result of the frictional drag of blood flowing over the surface of the vascular wall. It is well established that fluid shear stress affects a variety of EC functions. However, whether shear stress affects the differentiation of EPCs is yet to be explored. Indeed, while enormous efforts have been made to understand how chemical factors (e.g., growth factors and cytokines) control EPC differentiation, the potential effects of mechanical factors on EPCs are unknown. In the present study, we studied the effect of shear stress on the differentiation of EPCs by using an in vitro flow system. Cryopreserved primary progenitor cells (isolated from a single donor's peripheral blood) were cultured on fibronectin-coated glass slides for 2 days supplemented with complete endothelial growth medium-2. These cells were then subjected to a venous level of shear stress at 5 dyn/cm^2. Next, the sheared cells were subsequently fixed in formaldehyde, permeabilized in Triton X-100, and then stained for a specific endothelial cell marker- endothelial nitric oxide synthase (eNOS). It was found that the sheared cells stained positive for eNOS, suggesting their differentiation towards ECs. We are currently working to determine whether the differentiation is affected by the magnitude of the shear stress (arterial vs. venous). These findings will advance our understanding of EPC differentiation at the biomechanical level.