STRONG CHILDREN'S RESEARCH CENTER

Summer 2014 Research Scholar

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ABSTRACT

Title: Differences Between Fetal and Adult Platelets

Background:
Platelets are anucleate cells that are an important component of many physiological mechanisms including thrombosis, hemostasis, and inflammation. In the adult, platelets are made from megakaryocytes originating in the bone marrow from hematopoietic stem cells. Interestingly, the production of the first platelets in the fetus is found preceding the appearance of these stem cells. Fetal platelets are produced from megakaryocytes differentiated from transient yolk sac progenitors. Previous research has demonstrated that compared to adult platelets, fetal platelets are larger, contain smaller alpha granules, a larger open canalicular system, and express higher levels of the integrin gpIIb. Recently, it has been found that upon activation, fetal platelets display a morphological change of the integrins gpIIb/IIIa (CD41/CD61, respectively), a result that parallels that of the adult. However, unlike adults, P-selectin is not brought to the surface during this activation cascade.

Objective:
Here we further explored various molecular and functional differences between fetal and adult platelets.

Results:
We establish that gpIIIa, the binding partner of gpIIb, is also preferentially increased in fetal platelets. Second, we were able to show using qPCR that transcript levels of P-selectin are decreased in fetal platelets as compared to adult platelets. Additionally, we found that fetal megakaryocytes also express lower transcript levels of P-selectin than adult megakaryocytes, indicating that P-selectin expression is regulated early in platelet production. One role of P-selectin is as the binding partner in the adherence of platelets to leukocytes upon platelet activation. To study the functional consequence of lower P-selectin expression levels, we are developing an assay using imaging flow cytometry to determine if fetal platelets are able to bind to leukocytes.

Conclusion:
Overall, we demonstrate that while the fetus makes platelets early in development, these platelets have unique characteristics that differentiate them from adult platelets. It will ultimately be important to determine if similar differences exist in human embryonic and adult platelets, given that ES/iPS cells may serve as a novel source of platelets.