Improved Blood Transfusion Screening with iPSC-derived Reagents

Published date: July 9, 2018

Technology description

Red Blood Cell (RBC) Reagents with Rare Antigen Phenotypes for Prevention of Alloimmunization Reaction in SCD Patients

Market Need

Sickle cell disease is an autosomal recessive blood disorder genes that leads to the affected patient's hemoglobin is abnormal, causing RBCs to become hard, sickle-shaped, and less efficient at carrying oxygen. There are over 4.4 million patients worldwide living with SCD, which is more prevalent in certain populations, such as in Sub Saharan Africa, Saudi Arabia, India, Mediterranean countries, and African Americans in the United States. Disease management can vary depending on the degree of severity of the disease, but hematopoietic stem cell transplants remain the only cure. Around 20% of SCD patients must receive chronic blood transfusions to maintain a healthy circulating hemoglobin. Before blood transfusion, a patient's serum is used to screen for their RBC specific antigens so that that the appropriate blood type can be transfused to minimize the risk of alloimmunization reaction or the formation of antibodies in response to foreign antigens in the transfused blood. The screening involves testing patient's serum against RBCs with a pre-identified antigen profiles to look for reactivity. For SCD patients, especially those who have received multiple transfusions, the rate of alloimmunization is 30-50% compared to 3% in the general transfused population. Many of these cases are caused by the lack of screening reagents for a group of Rh antigens that are highly variable in SCD patients in particular. Thus, there is a need for better screening reagents that could potentially prevent alloimmunization reactions in this group of patients.

Technology Overview

The Chou Lab has harnessed the power of induced pluripotent stem cells (iPSCs) and CRISPR technology to develop RBCs with antigen phenotypes that are rare in the general population to be able to use as screening reagents to determine Rh antigen profile. The Chou lab has a focus in transfusion medicine and a particular interest in the SCD population. The Chou lab and collaborators were the first to show the high variability in Rh genes in these patients and identified the specific defined antigen profiles that would be useful to have on hand for screening purposes. They used CRISPR to modify iPSCs, which are then put through a defined differentiation protocol to create these rare antigen RBC reagents (i.e. Rh null and D—antigen profiles). Currently, the only alternative for SCD patient screening is to send the sample to a reference lab that has more specialized reagents and is a process that could

delay transfusion by weeks. Rare antigen profile RBCs created through iPSCs will allow prevention of alloimmunization reaction in SCD patients at point of screening.

Application area

• Screening before blood transfusions for SCD patients
• Development of rare antigen phenotype red blood cell reagents

Advantages

• Limitless source of RBC reagents because they are derived from iPSCs (independent of patient samples)
• Quicker than current standard of sending SCD patient samples to a reference lab

Institution

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