SICKLE CELL ANEMIA

Brandon Stephen
Scientific supervisor: Myronchenko S.I.
National University of Pharmacy, Kharkiv, Ukraine
Brandonstepehen@gmail.com

Introduction. Sickle cell disease is one form of hemoglobinopathy - a structural abnormality in hemoglobin molecule. Sickle Cell Anemia (SCA) is a genetic disease based on a single base pair substitution which affects the body in multiple ways (substitution of glutamic acid by valine at the 6th position). The oxygen carrying protein in red blood cells causes them to sickle due to this mutation. SCA affects millions of people worldwide. SCA predominantly affects African-Americans. The region of the world most detrimentally affected by this disease is northern Africa, where one-third of inhabitants carry the gene. In Africa, 50% of children with SCA die within 1 year of life, less than 10% survive to adulthood. A genetic mutation has allowed sickle-cell carriers to be resistant to malaria.

Aim. Carry out an analytical review of SCA development mechanisms and the most promising methods of its treatment.

Materials and methods. Data analysis of literature and Internet sources.

Results and discussion. The hemoglobin in these sickled cells causes them to form long fibers which stick together because of an amino acid change from a polar residue to a non polar residue. This creates a patch of non-polar amino acids which can polymerize in hemoglobin's deoxygenated form. These fibers poke and damage the membrane warping it into a sickle shaped. This also causes ion transport leading to water loss. Calcium ions build up and active the Gardos channel, an exchange of calcium and potassium ions, which causes a vicious cycle as dehydrated cells are more likely to sickle. Under conditions of low oxygen, however, more cells begin to sickle. These sickled cells become more sticky and then they begin to clump together. This can clog these capillaries causing pain and damage to different organs due to lack of blood flow and oxygen. A sickle cell crisis occurs when the red blood cells sickle (become "C" shaped) and stick together in clumps. The main treatment options do not cure SCA but they do reduce the outbreaks and help keep symptoms under control. Current treatments include Hydroxyurea and nitric oxide. Research is being applied to butyrate and Clotrimazole which increase the unaffected fetal hemoglobin levels and help keep cells hydrated which reduces sickling respectively. Clotrimazole works by inhibiting the Gardos channel.

Conclusions. The high prevalence of SCA, the lack of conventional etiopathogenetic therapy, indicate the need for a further comprehensive study of the pathogenesis of SCA.