Sickle cell disease patients are vulnerable to kidney illness according to a recent collaborative study from Ghana and USA.

Brief Abstract

Growing up in West Africa, it is common to know a family member or a neighbor with sickle cell disease (SCD) and unfortunately some of these friends, and family members died at a very young age. Unfortunately, SCD itself cannot be cured, only a treatment of the symptoms including the management of acute and chronic pain can be provided.

In a 2020 issue of *Blood* journal led by **Dr. Ofori-Acquah**, a Professor affiliated with *Kwame Nkrumah University of Science and Technology* in Ghana and the *University of Pittsburgh* in the United States, the authors found that high heme, a molecule derived from red blood cells, results in kidney damage in the condition of SCD due to the lack of a natural and biological heme binder called hemopexin. These discoveries suggest that extra precaution should be taken by SCD patients to prevent hemolytic conditions which can be caused during severe malaria infections.

Sickle Cell Disease Overview

Sickle cell disease (SCD) affects millions of people throughout the world and is particularly common among those whose ancestors came from sub-Saharan Africa. According to the Centers for Disease Control and Prevention (CDC), “SCD occurs among about 1 out of every 365 Black or African American births and alarmingly, 1 in 13 Black or African-American

babies is born with sickle cell trait (SCT)" suggesting a genetic susceptibility of African descents on SCD.

Scientific progress has contributed to drop the SCD-related death among Black or African American children younger than 4 years of age by 42% from 1999 through 2002 in the United States coinciding with the introduction in 2000 of a vaccine that protects against invasive pneumococcal disease. This data suggested that environmental factors such as infection diseases represent a key factor in exacerbating the disease outcome.

Sixty five percent of people carrying sickle cell mutation live in in sub-Saharan Africa (west and central Africa). Unfortunately, sub-Saharan Africa is also the region where the prevalence of hemolytic infection diseases such as malaria is elevated. Resulting from the precedent elements cited in addition to the lack of adequate treatment, the childhood survival for SCD in Africa is 10% compared to a 99% and 94% in UK and USA respectively.

Therefore, it is critical to study and isolate the environmental factors involved in the severity of SCD. Dr. Ofori-Acquah and colleagues studied whether environmental factor which could result in heme increase through hemolysis could dramatically change the disease outcome of SCD patients.

Therapeutic targeting of extracellular heme to prevent kidney damage in SCD patients

It is known that the lysis of red blood cells, a phenomenon frequent in SCD patients, generates hemoglobin which can be converted to heme through biological process called "autooxidation to ferric hemoglobin". In healthy person, the presence of heme in the blood is sequestered by a molecule called Hemopexin with the goal to prevent heme toxicity.
Dr. Ofori-Acquah and colleagues studies highlight a critical role of increase heme in blood in kidney injury. They found that SCD patients have a reduced

heme-binder, hemopexin and in the context of increase heme in blood in SCD patients, the heme could be transported to kidney which provoke kidney damage instead of liver which is known to detoxify heme.

Takeaway and recommendations

SCD disease severity results both from the interactions of gene and environment factors. While we cannot do too much in term of our gene fate, the recent study of Dr. Ofori-Acquah shows convincingly that avoiding extracellular heme rise is a protective mechanism against acute kidney injury in SCD patients.

In a real world, what can we do to prevent heme crisis in SCD patients:

- Take an extra precaution to avoid infection. For instance, microbe molecules have been shown to adsorb onto the surface of red blood cell causing hemolysis.
- Check with your doctor and dietitian about a recommended diet to prevent hemolysis. For example, an insufficient level of selenium in patients with SCD has been associated with hemolysis, according to a previous study published in the journal Nutrients.

Further pre-clinical studies and clinical studies should investigate whether hemopexin replacement could be used as a therapy to improve SCD outcomes as well as protecting SCD mice from acute kidney injury.