

The Correlation Between Malaria and Sickle Cell Anemia

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Introduction

- Malaria is caused by a parasite called Plasmodium Malariae living in the red blood cells of a human. It reproduces inside the cell and will eventually explode the cell, causing the symptoms we associate with malaria.
- Sickle cell anemia (abbreviated as SCA) is a genetically inherited disease that causes red blood cells to have a shape like that of a crescent moon due to a mutation in their hemoglobin coding gene. Some people can inherit one copy of the SCA gene while their other copy of the gene is normal (they are heterozygous for the mutation) so only half of their red blood cells are sickled. This can cause them to not have symptoms of SCA, but still have the cells.
- There has been a noticeable correlation between the two diseases for a long time, but researchers are not sure why they relate to each other.



Figure 1: Sickled red blood cell (left) vs. normal red blood cell (right)

Objectives and Methods

- The objective of this project was to analyze how sickle cell anemia and malaria can affect each other through an archival study, based upon two studies.

Results

- Sickled cells have also been found to release higher levels of carbon dioxide into the bloodstream (De Lange, 2011).
- A significantly a smaller number of deaths by malaria were reported in people who were heterozygous for SCA, where only half of their cells are sickled (Elenore, 2020).
- Another theory introduced by scientists as to why sickled cells could provide protection against malaria is that the body could phagocytize its own sickled cells, thus killing the parasites (Gong, 2013).

Results

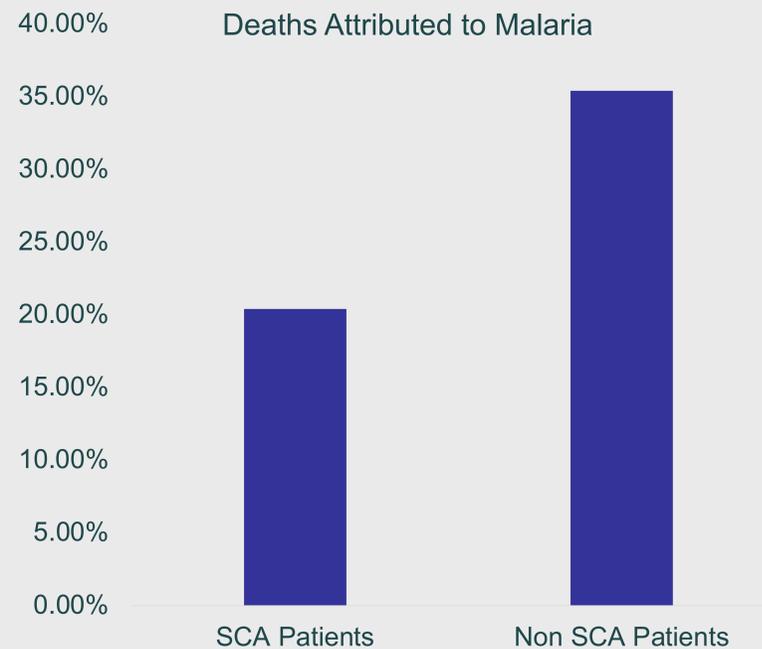


Figure 2: Occurrences of malaria deaths at the Laquintinie Hospital during an outbreak

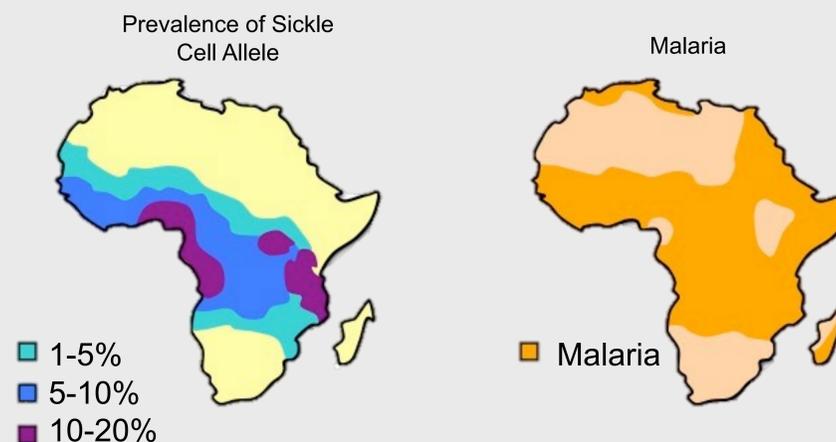


Figure 3: Relationships between areas where malaria is prevalent, and the sickle cell gene exists in the population.

Conclusions and Future Directions

One can conclude that the presence of sickle cell anemia affects the lethality of malaria.

- The significant difference in death percentages with those with SCA and those without indicates correlation.
- A theory that I agree with after researching is that the production of excess carbon dioxide by sickled cells makes the CO₂ levels in the blood lethal for the malaria parasite, thus it cannot reproduce, and patients do not experience symptoms as severe as they would if the parasite could live in their blood.
- People who are heterozygous for SCA could have an advantage against both malaria and SCA; since only half of their cells are sickled, half of the cells work properly, creating no SCA symptoms, and half of the cells produce enough CO₂ levels to kill the parasite that causes malaria.
- This could change the future for how malaria is treated. Scientists could potentially simulate SCA inside a person's bloodstream by changing CO₂ levels, making the parasite easier to kill, thus making the patient less symptomatic.
- There is still much work to be done in this area but recognizing the correlation could be beneficial for a cure to malaria.

Literature Cited

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